The JOURNAL OF ELECTRICITY
POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

PUBLISHED WEEKLY

By the Technical Publishing Company, Atlas Building, 604 Mission Street, San Francisco Cal.
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879.

Vol. XVIII No. 21 San Francisco, Cal., May 25, 1907. Yearly subscription $2.50 Single copies 10 cents Back numbers prior to current month 25 cents.

OKONITE WIRE

OKONITE TRADE MARK REG. U.S. PAT. OFFICE

The Standard for Rubber Insulation

Okonite Tape, Manson Tape,
Candee Weather-proof Wire,
Candee (Patented) Potheads.

THE OKONITE COMPANY, 253 BROADWAY, N. Y.

STANDARD UNDERGROUND CABLE CO.

MANUFACTURERS OF

BARE AND INSULATED WIRES AND CABLES

CHICAGO PITTSBURG PHILADELPHIA ATLANTA
NEW YORK BOSTON ST. LOUIS SAN FRANCISCO
LOS ANGELES OAKLAND SEATTLE

PACIFIC COAST DEPT. A. B. SAURMAN Pacific Coast Mgr. BACON BLOCK, OAKLAND, CAL.

Meese & Gottfried Company

19th and Harrison Sts., SAN FRANCISCO

Power Transmitting Machinery

Of all description. We have a larger stock of Shafting, Hangers, Boxes, Pulleys, etc., than ever.

Seattle *San Francisco* *Los Angeles*

VULCAN

Refrigerating and Ice Making Machinery

Manufactured by

VULCAN IRON WORKS

OFFICE: 702 ATLAS BLD'G. 604 MISSION STREET WORKS: FRANCISCO NND KEARNEY STS.

San Francisco, California.

INDIANA RUBBER AND INSULATED WIRE CO.

MANUFACTURERS OF

PARANITE AND PEERLESS RUBBER COVERED WIRES AND CABLES

Underground, Aerial, Submarine and Inside Use
TELEPHONE, TELEGRAPH AND FIRE ALARM CABLES

All Wires are Tested at Factory JONESBORO, IND.

ELECTRIC APPLIANCE CO.

315 Main St., San Francisco Pacific Coast Agents

San Francisco Los Angeles Oakland

HENSHAW, BULKLEY & CO.

CONTRACTORS EQUIPMENT OF ALL KINDS

219-221 Spear St. San Francisco, Cal.

Bristol's Recorders

For Every Electric Light
Railway, Power and Gas Plant Compel

Safe and Efficient Operation

Send for Catalogue A. V.

The Bristol Co., Waterbury, Conn.

N. Y., 114 Liberty St. Chicago, 753 Monadnock Block

The National Conduit & Cable Co.

Manufacturers of

TROLLEY WIRE

BARE COPPER WIRE AND CABLES
WEATHER-PROOF WIRES AND CABLES
PAPER-INSULATED CABLES

FOR TELEPHONE, TELEGRAPH AND POWER

703 MONADNOCK BUILDING, SAN FRANCISCO

C. H. PENNOYER, PACIFIC COAST MANAGER

BROOKS-FOLLIS ELECTRIC CORP.

Electrical Supplies of all Kinds in Stock

214 FIRST STREET, Cor. Tehama SAN FRANCISCO

OAKLAND, 563 13th Street

PACIFIC METER CO.

MANUFACTURERS OF

WET AND DRY GAS METERS, STATION METERS, PROVERS, GAUGES, ETC.

917 AND 918 MONADNOCK BUILDING. SAN FRANCISCO, CAL

VAN EMON ELEVATOR CO.

MANUFACTURERS OF .... HIGH-GRADE ELEVATORS

R. J. DAVIS, President
B. C. VAN EMON, Vice-President and Manager
H. B. RATHBONE, Secretary and Treasurer

NOT IN THE ELEVATOR TRUST

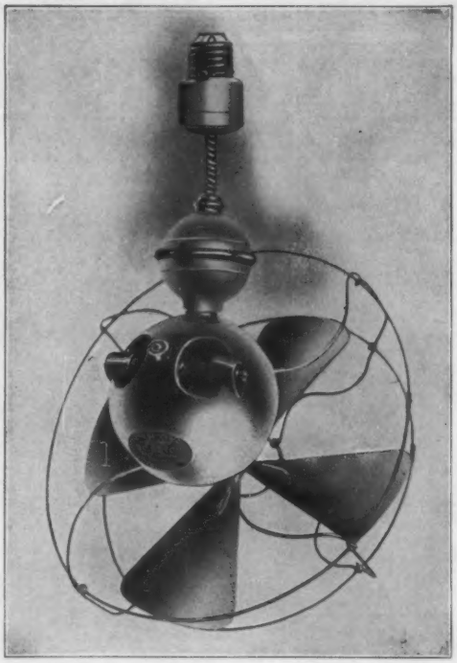
DIRECTORS
LOUIS F. MONTEAGLE W. P. PLUMMER
GEO. M. PINCKARD R. S. HUNKINS

OFFICE AND CONSTRUCTION DEPARTMENT
52 - 54 NATOMA STREET, SAN FRANCISCO

FACTORY AND FOUNDRY
WEST BERKELEY, CAL. (32,000 sq. ft.)

FAN WEATHER COMING

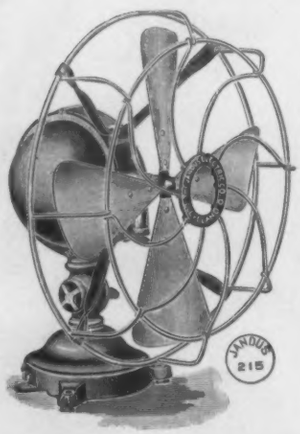
"JANDUS"
A. C. & D. C.
Combination
Desk-Bracket
Fans



"WOOD"
A. C. & D. C.
Revolving and
Desk Type
Fans

Century A. C. Ceiling 2 and 4 Blade 58" Sweep. JANDUS A. C. and D. C. "Gyro" 12" and 15" Fans.

Special Quantity Prices
Factory or S. F.
Delivery
Standard Goods



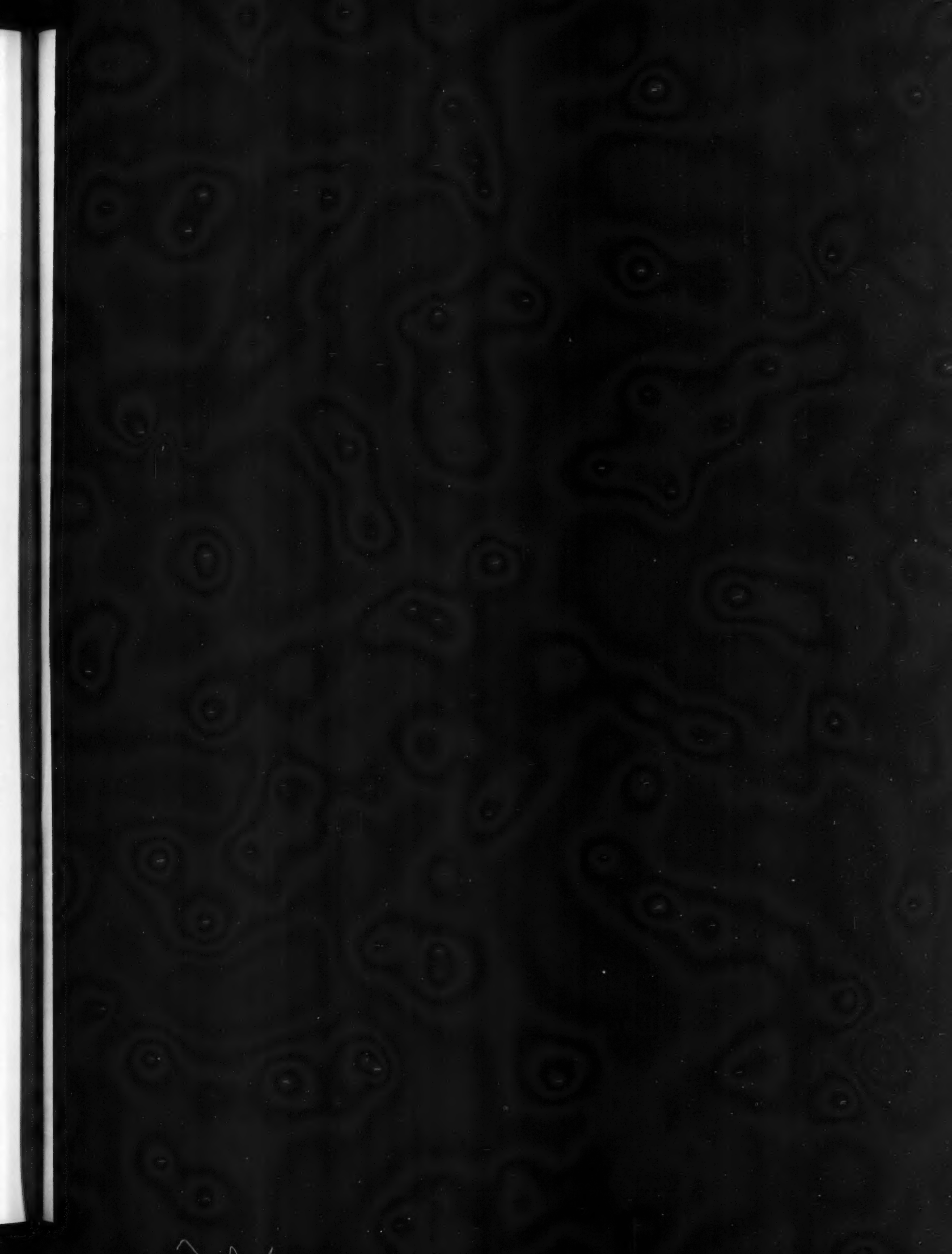
Write us your
Requirements
Standard Prices

Standard Electrical Works

58 - 60 Natoma Street

DISTRIBUTERS

San Francisco



THE

Journal of Electricity, Power and Gas

WITH WHICH IS INCORPORATED

The Engineers' Architects' and Builders' News

VOLUME XVIII. SAN FRANCISCO, CAL., MAY 25, 1907 No. 21

THE ELECTRICAL SCHOOL, NAVY YARD, MARE ISLAND.

Commander H. C. Gearing, U. S. Navy.

In the Journal of Electricity of June 9, 1906, reference was made to the Electrical School established at Mare Island to help fill the navy's need of electricians, employed both afloat and on shore and at wireless telegraph stations. This school was opened in March, 1905, and since then it has sent out into service as general electricians and wireless operators one hundred graduates.

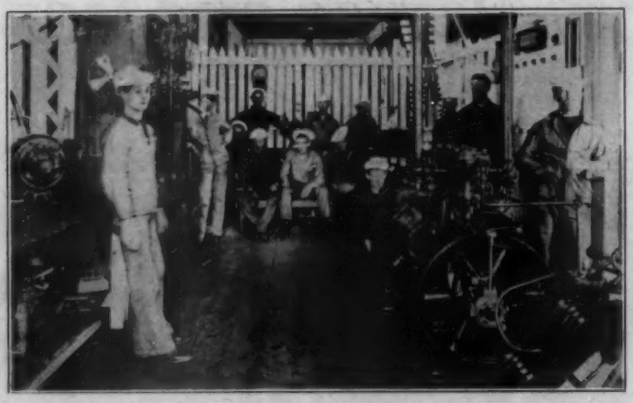
By general electrician is meant a man capable of filling all the electrical duties that arise on board a man-of-war, including dynamo tending, detection of grounds, care of all electrical apparatus, and making of minor repairs. Wireless operators, of course, are those whose duties lie with the wireless telegraph, with which all our men-of-war above 2000 tons displacement are now equipped. It is required that all electricians in the navy must qualify in both branches. That is, the general electrician must be familiar with the wireless apparatus, know the code and be able to manipulate the key and receive a message; on the other hand, the operator must understand electricity, be capable of dynamo-watch standing, and, generally, of taking part in the ship's electrical duties. Therefore qualifying marks in both branches are required for promotion in the service and for graduation from the Electrical School. But the value of specialization is recognized especially in the school and students are encouraged along that line wherein they give most promise.

FIRST CLASS IN SCHOOL, MAY, 1905.

The inauguration of the school was coincident with the beginning of wireless telegraphy in the Pacific. And happily so; for, with the exception of one or two operators, all those manning the ten wireless telegraph stations now established on the Pacific Coast, the station at Honolulu, and the one at Guam are manned by graduates of the Mare Island school. No other source could have provided them. The need for these operators was pressing and continues so, for graduates have found places also on the ships of the Pacific and Asiatic squadrons. Of the one hundred graduates about one-half are wireless operators.

It must be understood that all are electricians arranged in the various classes or grades with pay varying for the different classes. The discrimination between general electricians and operators is one that is made by the officers in charge, based on the men's records and adaptability. What the different electrician ratings are and the pay of each will be noted later.

The course in the school lasts five months. It is not an elementary one, for the young men taken into it must be either electricians by trade or men who have had experience in handling dynamos or other electrical apparatus or who possess some knowledge of telegraphy. The course is wholly practical. No text work at all is required. The hours are from 8 to 11:30 a. m. and from 1 to 3:30 p. m. for five days in the week. The students are quartered on the receiving ship Independence, with excellent food and bathing facilities. A reading room, tennis, handball, baseball, football and track athletic grounds are near by. While no textbooks are used in the school, book-work is counted of value in a young man's improvement. He is supplied with excellent, up-to-date manuals on electricity and wireless telegraphy and has access to a growing library on mathematical and technical subjects, of which the student body is encouraged to make full use in the ample leisure time left from school hours. The city night school in Vallejo is open to them and permission to attend is easily obtained. No great literary qualifications are



ELECTRICAL SCHOOL, MAY 1905

demanded, except that for operators it is exacted that they must be able to spell decently and frame a message in intelligible sentences.

The course is a practical one. It aims to have the young man know the construction and manipulation of electrical machinery by tearing it apart and putting it together, actually handling the parts, and then operating it. The apparatus now installed—dynamos, motors, oil engine, switchboards, storage batteries and the many electrical ship appliances—have all been put in place by the students, the machines being those which have been found as unfit or not needed for ship use. These have been torn out of the ships, the parts cleaned and overhauled, and then been mounted again, all the work being done by the school. As a result, there are at present eight dynamos of various sizes and nearly as many types, an oil engine, several motors, several storage batteries, etc., all in good working order. Two generators that had been placed in first-class condition were sent to a ship at another navy yard, and others will be similarly disposed of to make room for two generators recently taken out by the class from a vessel that is about to be sold. It is thought that no instruction can be so valuable as this tearing apart and putting together when the shortness of the course is considered. All the many electrical appliances found on a ship, taken from vessels repairing, are placed in the school by the class, and when needed are removed, to be replaced by similar appliances belonging to other ships. This is considered equally valuable instruction, for it is to be remembered that there is a continual flux of students, some leaving while others are entering. The school assists in tests in the electrical laboratory connected with the navy yard, and with one of its own dynamos keeps the storage battery in the laboratory charged.

ARC. MEASURING APPARATUS

Entrance is made at any time and there is no vacation time. No specific course can be laid down to be rigidly followed, for, besides entering at different times, the students also enter with widely differing degrees of preparation.

For instruction in wireless telegraphy the school has a 120-foot mast by which messages can be exchanged between the school and the wireless stations at the navy yard, Yerba Buena and the Farallon Islands. The school can not be said to possess any sending apparatus of its own, for no sooner have the students installed a set after alteration or repair than it has been found necessary to turn it over to some ship or shore station and begin the process of setting up another. This is beneficial rather than disheartening. New sets received at the yard for issue to ships or stations are set up and tried out. Experiments with different forms of aerial wires and receiving instruments are made, and here care must be exercised to see that this is not overdone. At first a room was specially fitted up for experimenting, to which the more advanced students had access. It was found that they neglected their practice with the sending key and receivers in order to indulge in curious experimentation. The room had to be closed in consequence, for the object is to

ELECTRICAL SCHOOL, MAY 1907

make proficient operators, and this can be done only by incessant practice.

Room for the school has been found by crowding into a building devoted to another use. It is pleasant to note that the work of the school has been appreciated and that money has been appropriated which will permit renovation of the present building and permits its being used wholly for school purposes.

Electricians in the navy are divided into the following classes, with pay for each class as shown:

Chief electrician	$60 to $70 per month
Electrician, first class	50 per month
Electrician, second class	40 per month
Electrician, thind class	30 per month
Landsman for electrician	16 per month

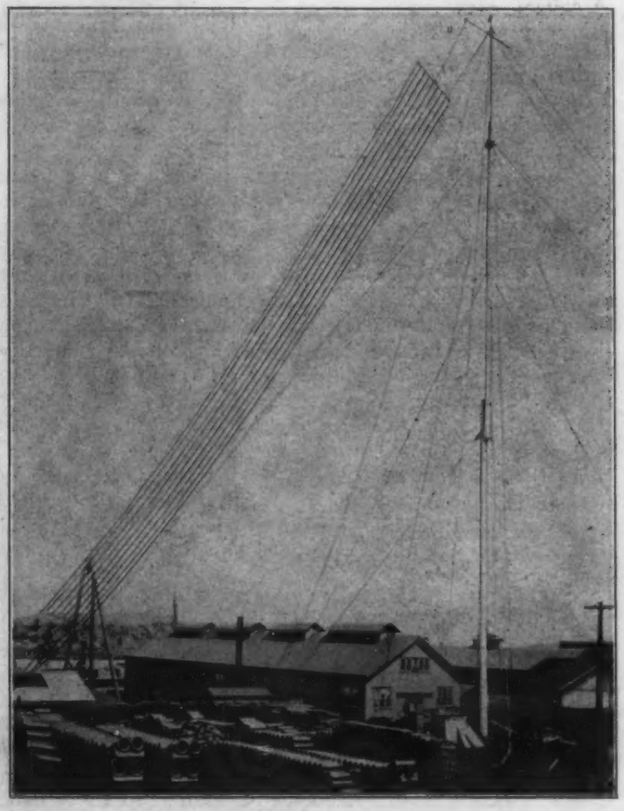
Enlistment is for four years.

In addition to the above pay, the emoluments of these grades, as for every man in the navy, are increased by an allowance on enlistment of $60 for clothing outfit, lodging, food, medical attendance and hospital, a pension in case of

physical disablement and a pension to family in case of death. Besides the above, there is the privilege of retirement on seventy-five per centum of current pay and allowances at the end of thirty years' service.

Applicants for enlistment as electricians must be electricians by trade and all first enlistments must be as electrician, third class. Any time after enlistment an electrician, third class, may be promoted to second class on favorable report after an examination in general electricity and wireless telegraphy, showing that he is qualified to stand a watch in charge of the dynamo room and to send and receive wireless messages. Promotion to electrician, first class, follows after a year if the second-class electrician shows that he is well grounded in the construction and use of all electrical apparatus on board ship and possesses a considerable skill in either branch.

To be eligible to the rate of chief electrician, in addition to the above, a first-class man must show a knowledge of



WIRELESS TELEGRAPHY MAST

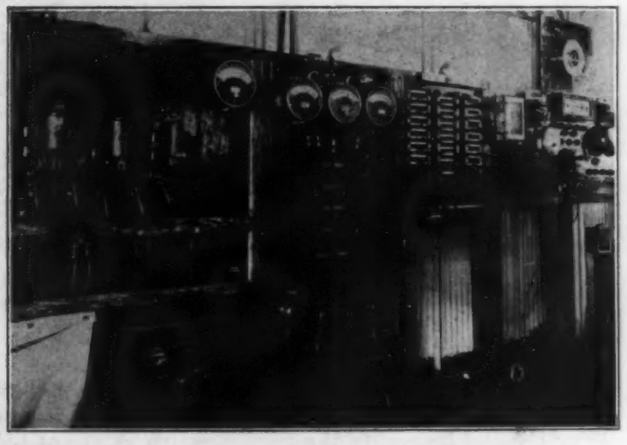
the care and use of storage batteries and oil or gas engines. Lately some service at sea in a navy vessel has been added to the needful qualifications for the rate of chief electrician.

In cases where applicants for enlistment in the electrical branch show some knowledge of electricity or telegraphy, but not sufficient to enable them to take up immediately duties as general electricians or wireless operators they are enlisted as "landsmen for electrician" and are sent to the school. The pay of landsmen is $16 per month. After successful completion of the course these landsmen are immediately promoted to electrician, third class. This is equivalent

WIRELESS TELEGRAPHY CLASS

to the Government's giving a young man five months excellent technical schooling and opportunity for study, supporting and paying him for it at the same time.

There have been all classes of electricians on the rolls of the school from chief electrician down. With all, except chief electrician, promotion of one class is accorded on successful completion of the course. Provision is also made whereby a student who shows himself exceptionally well qualified may be advanced two classes. Only young men of good character, industrious habits and correct behavior, with



SWITCHBOARDS

some ambition to advance themselves, are desired. Very little weeding out has been necessary. A glimpse of the intelligent faces of those now in the school and the creditable records of its graduates show how well the school has maintained its standard.

MEETING NOTICE.

The next meeting of the Association of American Portland Cement Manufacturers will be held at the Hotel Chamberlin, Old Point Comfort, Va., June 10, 11 and 12. There will be no papers read.

THE MOORE VACUUM-TUBE LIGHT AND THE LUMINOSITY OF GASES.*

By C. J. Thatcher, Ph. D.

The past few years which have witnessed a rapid improvement in the arc and incandescent forms of electric lighting have also seen the commercial application of a new and distinct type of lamp; that is, the enclosed vapor or vacuum-tube lamp. Three forms of this type have become generally known. The first of these is the Cooper Hewitt, which is now widely used and well understood; a second is the Bastian, which, like the former, is a mercury vapor arc lamp, but of smaller dimensions and provided with an incandescent carbon filament lamp to provide red light rays; the third is the Moore vacuum tube. Since the latter has recently given evidences of commercial practicability and is perhaps not thoroughly understood, a brief description of it and consideration of its salient features will be given here. It will be shown, also, that certain phenomena observed in this tube may have an important bearing on the question of the nature of gaseous luminosity in general and one which has not been previously recognized.

Mr. D. McFarlane Moore began to experiment about twelve years ago for the purpose of producing a "cold light"; that is, one in which all the electrical energy would be converted into light without any loss in the form of heat. At that time the maximum lighting efficiency was obtained with the arc lamp, consuming one watt per candlepower. Dividing this value into the theoretical figure for the conversion of electrical energy into light as given by Dr. E. F. Roeber—one spherical candlepower per 0.115 watt—we see that only about ten per cent. of the electrical energy is converted into light in this form of lamp, the other ninety per cent. is dissipated and lost in the undesirable form of heat.

Since then, however, illuminating art has been much improved, so that we now have a maximum lighting efficiency of fifty per cent. in the flaming arc lamp, which consumes only 0.23 watt per candlepower. The most efficient form of the Moore light, that is, the one in which rose-red light rays predominate, has a maximum efficiency of about three-fourths watt per candle, and is but little better than that of the older form of arc light. The heat loss is, therefore, about eighty-five per cent. in the most effitient form of the vacuum-tube lamp.

Description of the Moore Vacuum Tube.

Although the "cold light" problem, therefore, is still unsolved, Mr. Moore's experiments have finally produced a novel and fairly efficient form of illumination, and one which possesses distinct advantages for some purposes. As it is now being installed it consists of a continuous stretch of one and three-quarter-inch glass tubing of any desired length; this is supported near the ceiling by suitable brackets and encircles the room or space to be illuminated.

This continuous length of tubing is made in situ by joining together six or eight-foot lengths, and at the corners previously shaped angle pieces. The joints of the tube are made in the manner long used for joining large-bore glass tubing in making chemical and physical apparatus; the blow-pipe employed is a slightly modified and movable form of that, having two impinging flames, which has long been used for that purpose.

The ends of the one-piece tube thus formed come together in a box about two feet square, which is suitably and inconspicuously placed. These ends are constructed of slightly larger-bore tubing for a foot or so, and are, of course, rounded and sealed at their extremity. They each contain an electrode of carbon electrically connected with the exterior by platinum wires sealed in the end of the tube.

These wires in turn are in electrical connection with a transformer, which raises the voltage of the alternating-current supply to 10,000, at which pressure the current is delivered to the tube.

Another essential part of the system, also placed within the box, is an ingenious vacuum regulator. This consists of a cone-shaped carbon pencil, sealed point upwards in the end of a narrow glass tube, sealed in turn to the main tube. Surrounding this carbon pencil and sealed to the narrow inlet tube which carries it, is a glass tube of larger diameter. The annular space thus formed contains enough mercury to cover the entire pencil, and in this mercury a metal tube displacer floats, attached at its upper end to the core of a solenoid placed above the regulator and in the lighting circuit.

The tube thus completed is evacuated by a Geryk or other mechanical vacuum pump to a pressure stated to be about 1/40,000 of an atmosphere. With the passage of the high-tension alternating current the tube immediately becomes luminous throughout, the light being a soft one with rose-red rays predominating.

A suitable manometer was first attached to similar tubes several years ago, which, however, were not then provided with a pressure regulator. It was then found that the rare faction of the gases in the tube slowly increased, and this was accompanied by perplexing resistance changes, which finally culminated in the failure of the light.

In order to secure a permanent light it has been found necessary, therefore, to admit very small portions of air to the tube at intervals. This is accomplished by the vacuum regulator which was devised subsequent to the measurement of pressure variations. When the air pressure decreases the internal tube resistance also decreases; more current flows though the solenoid of the regulator, and the core thereupon rises a trifle, withdrawing the displacer so that the mercury falls enough to uncover the tip of the carbon pencil.

This is thereby exposed to atmospheric pressure, and a small bubble of air, to which the pencil is not impervious as it is to mercury, filters through the carbon; the normal vacuum and resistance are thereby restored and the mercury rises again, shutting off the air supply. Practically normal tube conditions can be thus maintained indefinitely, and tubes thus automatically controlled have had a life of 1,000 hours or more.

The circuit is conducted through the Moore tube from terminal to terminal solely by the highly-rarified gases, and these alone are the source of the light it emits. The Moore light, therefore, is only a lengthened Geissler tube; its light may at times exhibit striated effects similar to those of this tube, but ordinarily these are not noticed by the eye.

Mr. Moore has, therefore, made a practical application of a mode of producing luminous effects which has long been known; which, indeed, was one of the earliest forms of light produced by electricity. Now that this form of light bids fair to have a commercial value, it is to be expected that the nature of it may be the subject of more frequent, or, at least, more successful, scientific investigation, for, strange to say, little is definitely known concerning the source of the luminosity of conducting rarified gases.

Theories of Gaseous Luminosity.

It will be interesting to note here the theories regarding luminiferous gases recently advanced by different investigators in this field. The older theory is that the gaseous molecules send out vibrations of a visible wave length as a result of purely physical collision or heat effects consequent on electrical conductivity. Regarding this theory, Prof. H. A. Armstrong, in 1902, in an article on "The Conditions Determinative of Change and of Electrical Conductivity in Gases, and

*From "Electrochemical and Metallurgical Industry."

on the Phenomena Luminosity," stated: "An argument which I think will sooner or later be regarded as of weight in favor of the view that the phenomena are electrolytic in their origin, is afforded by the luminous manifestations in vacuum tubes. These can scarcely be mere collision effects or mere heat effects. It has long seemed to me that luminosity and line spectra are the expression—the visible signs—of the changes attending the formation of molecules from their atoms, or, speaking generally, that they are the consequence of chemical changes, a chemical change being one which involves an alteration of molecular composition, or it may be of molecular configuration, as it is conceivable that even changes involving isodynamic (tautomeric) molecules—changes in molecular structure unattended with change in molecular size—may give rise to such manifestations." Prof. Armstrong believes gaseous luminosity to be the result of chemical activity, therefore.

Prof. J. Stark, of Gottingen, on the other hand, who has made extended researches in this field, believes it to be a purely physical phenomenon, according to the following translated statement: "The line spectrum of a gas has its source of energy in the kinetic energy of the particles of the ionized gas, its conduction in the positive ion atoms. * * * The band spectrum of a gas, on the other hand, probably has its source of energy in the potential energy which the positive and negative ions possess in respect to one another, and which on recombination can be changed, at least partly, into light energy."

But a third authority, Dr. C. P. Steinmetz, in an address before the American Institute of Electrical Engineers, on "The Transformation of Electric Power Into Light," in November, 1906, stated, regarding Geissler and vacuum tubes: "The mechanism of this light production does not seem to be known, but the light seems to be somewhat of the character of a by-product."

What May Be Learned from the Moore Light Concerning Luminous Gases.

It has not been recognized, so far as I am aware, that the observed constant decrease of gaseous pressure in the Moore tube may have an important bearing on the question as to the cause of the luminosity of the gases contained in the tube, and, indeed, of conducting gases in general. As has been already stated, it has been found necessary to feed the tube with air at frequent intervals. As a matter of fact, very small portions are added every minute or so during use. This, of course, can mean nothing else but that chemical reactions are occurring which result in an increase of molecular size, and therefore in a decrease in the number of molecules and of the volume of gas.

The substances in the tubes in considerable amounts which might cause such reactions are, of course, nitrogen and gen and the carbon of the electrodes. Of the known reactions into which these might enter, those involving cyanogen formation, either as an intermediate or as an end product, cannot cause reduced pressure. The formation of ozone from oxygen, on the other hand, would cause reduction in the number of molecules and a higher vacuum. Ozone, however, is rapidly decomposed into oxygen again at temperatures below that of the interior of the Moore tube when in use, so that ozone cannot be a stable end product, nor can its formation cause the reduced pressure.

This leaves only the uniting of nitrogen and oxygen to form one of the oxides of nitrogen as the probable cause of the phenomena. The formation of NO and of N_2O_5 as end products would not result in reduced pressure, while that of N_2O, NO_2 or of N_2O_3 would. Of these, NO_2 is the more probable end product, but this investigation must, of course, verify.

It is true that solid brownish-colored deposits are frequently formed in the body of the tube; but it is highly improbable that they are the products of reactions causing the observed gaseous contraction, for they are by no means invariably formed after prolonged use, and may, indeed, appear, either very soon after installation or not at all. They are, in all probability, due, therefore, to impurities or variations in the composition of the terminals or of the glass tubing.

It seems certain, therefore, that the formation of one or more of these oxides of nitrogen is the cause of the reduced pressure of the tube. Apparently, Mr. Moore has come to the same conclusion—it may be by investigation—for he has often spoken of his light as one which "burns air."

Now, numerous investigations on the fixation of atmospheric nitrogen have demonstrated that the formation of oxides of nitrogen are purely thermal effects. (See Prof. Guye, this journal, 1906, p. 136, and Foerster and Nernst, Ibid. p. 256). This being the case, the oxides of nitrogen will be formed in the tubes wherever there is sufficient heat development, and that is throughout the tube, since eighty-five per cent. of the electrical energy put into the tube is converted into heat. Throughout its entire extent it becomes uniformly hot.

The heat development of the terminals is not appreciably greater than in the body of a tube, though bolometric measurements may show some slight difference. But this is certainly not considerable; so that in view of the far greater reacting volume of gas in the body of the tube it appears that the formation of oxides of nitrogen takes place in the Moore tube throughout its entire extent where it is accomplished by the emission light.

The chemical actions here involved may not necessarily be direct ones. Ozone or other unstable but active molecular complexes may be concerned in it, and the reactions may be reversible and have low reaction velocities, but the sum total result of electrical activity in the Moore tube is, apparently, the formation of a stable oxide of nitrogen accompanied by and intimately connected with the continuous emission of light rays.

This conclusion is important in that its verification will furnish a practical substantiation of the theory of the chemical nature of gaseous luminosity advanced by Prof. Armstrong and already cited in this article. And verification is not difficult; it includes two steps: First, identification of the substances formed in a tube and an investigation whether the concerned reaction velocities are greatly influenced by heat. Second, an observation of the effect of temperature variations in the conducting gases on the candlepower of the light which they emit, these temperature variations to be controlled by means external to the tube. If, for example, NO_2 is formed, and if the reactions producing it give rise to luminous effects, then cooling the tube to a very low temperature during its activity, e. g., by liquid air, would lower the candlepower, for the velocity of NO_2 formation is greatly retarded by reduced temperature (see Guye, Foerster and Nernst, loc. cit.).

The probable result of such an experiment is indicated by one cited by Prof. Armstrong. He states that Prof. Dewar, in an experiment before the Royal Institute, cooled a phosphorescent Crookes tube with liquid air and that its discharge at once ceased. Prof. Armstrong attributes this result to catalytic, rather than thermal effects. If cooling to a low temperature produces similar effects in the Moore tube, as from the close analogy it may be expected it will, the dependence of the luminosity of a mixture of conducting gases on the velocities of gaseous chemical reactions will have been proven. This could not before have been proven, because only a vacuum tube as extensive as the Moore tube could give reaction products in amounts which could be identified.

Experiments such as suggested, if they verify the theory outlined above, will also teach several things about the Moore tube and vacuum-tube lamps in general. The first of these is that in order to secure high-efficiency gaseous

light-emitting reactions must be employed which are exothermic or whose reaction velocities possess a relatively low temperature coefficient. That is, it must not be necessary to change much of the electrical energy into heat in order to maintain the high temperature for a rapid reaction velocity, as is necessary in the formation of oxides of nitrogen. Or if suitable reactions of this nature can not be found the necessary acceleration of reaction velocity must be secured by the use of catalytic agents.

The second conclusion to be drawn from the above theory—an inference, indeed, which is palpably evident from what is already known concerning the Moore tube—is that there is a limit to its life. Air is constantly admitted to the tube, enters into chemical reaction therein, and the reaction products remain in the tube. If gaseous they will gradually accumulate therefore, and ultimately extinguish the light by displacement of the active gases; even if they were solid they would coat the interior of the tube and make the light very inefficient. It is to be expected that the Moore tube will occasionally need repair, therefore, though the contrary seems to have been stated.

Advantages and Defects of the Moore Vacuum Tube Light.

Mr. Moore claims for his light a high efficiency, good actinic value, low intrinsic brilliancy, safety, perfect illumination without shadows and a very long life, indeed, that it will last for years without repair. The efficiency of the tube has recently been the subject of careful photometric tests by the New York Electrical Testing Laboratories, which showed that the average luces per unit energy were 20.0 for the Moore, 11.2 for the Nernst, and 3.6 for the carbon-filament incandescent lights, which is equal to .65, 1.1 and 3.5 watts per candle power, respectively. This efficiency is for the rose-red light only. In tubes emitting white light the efficiency is stated to be only about half the above, that is, 1.5 watts per candle power. This is not as high an efficiency, therefore, as is obtained with the metallic-filament incandescent lamps now being introduced.

Mr. Moore at the present time rarely installs tubes giving a white light, probably because of their lower efficiency and unreliability; it is necessary to introduce other substances, and the tube conditions favorable to a long life or even satisfactory service are not yet thoroughly understood. The white light only is suitable for general use, of course, but the rose-red tint is satisfactory for exterior lighting and in rooms where proper color values are not essential.

The principal advantage of the vacuum tube is its low intrinsic brilliancy. Its light is but 12-candle power per linear foot. It has no extremely bright portion common to nearly every other form of artificial light, which strain the eyes whenever they are in the angle of vision. This evil is now being lessened somewhat by the general use of frosted globes or shades, but even these do not bring these other forms down to as low an intrinsic brilliancy as that of the Moore tube.

The perfect illumination without shadows, that is, from every angle of the room, which has been claimed as an exclusive advantage of the Moore tube, is equally well secured by the use of small units like low candle-power incandescent lamps suitably placed entirely around the sides of the room or on the ceiling at intervals of a foot or so. This method of installation produces the freedom from shadows quite as well as does the Moore tube.

The tubes are difficult to repair, and leave the room entirely without lighting facilities for a long time in case of a failure or accident to any part of the system. This fact, the high initial cost, and its want of what may be termed flexibility, that is, the impossibility of turning off or on at will a part of the tube illuminating any desired portion of the room, will militate against the rapid adoption of the Moore lamp for general illuminating purposes.

STARTING ARRANGEMENTS FOR GAS ENGINES.

For gas engines of 100 brake horsepower and upwards, the starting arrangements should be most carefully considered if a proper degree of certainty in starting is to be secured. In such sizes there are two chief methods employed, viz., where an initial charge of explosive mixture is pumped into the cylinder and then ignited to obtain the first impulse, and the alternative to this is to provide a supply of compressed air for putting the engine in motion, after which it automatically draws in the first charge in the usual way. In both cases it is customary to fit either a friction clutch or a fast and loose pulley to the main drive from the engine, so that it may start free from external resistance. In view of sizes of the belts involved, which are unwieldly for shifting from fast to loose pulleys, and of the frequent application of rope drives, friction clutches are being increasingly employed, and a word of warning in respect of them will not be out of place. There are good clutches and bad clutches, and of the latter it may be said that there is no appliance which will cause more worry and trouble than a bad clutch. It is almost superfluous to add, therefore, that only the best clutch should be considered for the purpose and in ordering, purchasers should state clearly for what purpose the clutch is intended, and that it must be amply strong for the work. On the whole, we would be inclined to advocate the invariable adoption of compressed air as a starting medium for engines of 150 horsepower and over, but the use of petrol as a means of supplying a powerful gas to the engine for starting purposes is also being increasingly employed with exceedingly good results.

POSTAL COMMISSION REPORT.

The American Weekly Publishers' Association, through its worthy president, W. D. Boyce of Chicago, sends a report on the postal commission's inquiry regarding second-class mail matter. While no drastic changes were made by the last Congress, yet a new postal bill is to be brought before the Sixtieth Congress that threatens to impose burdensome restrictions on the publisher that cannot but be shown by an increased subscription price. The association is working to prevent this and in the words of Mr. Boyce, "to work constantly for lower rates, fairer and better postal conditions, and a 'free press,' untrammelled by bureaucratic or commission ruling, but supported by the dignity and justice of court decisions." Following is Mr. Boyce's creed:

"Do not keep the alabaster boxes of your love and tenderness sealed up until your friends are dead. Fill their lives with sweetness. Speak approving, cheering words while their ears can hear them, and while their hearts can be thrilled and made happier by them; the kind things you mean to say when they are gone, say before they go. The flowers you mean to send for their coffins, send to brighten and sweeten their homes before they leave them.

"If my friends have alabaster boxes laid away, full of fragrant perfumes of sympathy and affection, which they intended to break over my dead body, I would rather they would bring them out in my weary and troubled hours, and open them, that I may be refreshed and cheered by them while I need them. I would rather have a plain coffin without a flower, a funeral without an eulogy, than a life without the sweetness of love and sympathy.

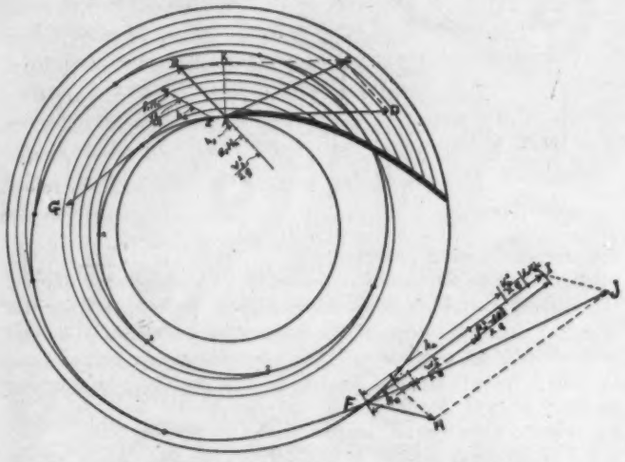
"Let us learn to anoint our friends beforehand for their burial. Post-mortem kindness does not cheer the troubled spirit. Flowers on the coffin cast no fragrance backward over life's weary way."

THE CENTRIFUGAL PUMP.

By E. N. Percy.

The lifting power of a centrifugal pump is proportional to the difference between its inside and outside diameter. If the inside and outside diameters are Da and De respectively, and Ua the tangential velocity of the inner diameter and Ue the tangential velocity of the outer diameter, the pressure or head due to the work of the pump will be $\frac{Ua^2 - Ue^2}{2g}$ and if Ut = angular velocity.

$$\frac{\left(\frac{Da}{2}\right)^2 - \left(\frac{De}{2}\right)^2}{2g} W = \frac{Ua^2 - Ue^2}{2g}$$



SPIRAL WITH ENTRANCE AND EXIT DIAGRAM

Either member, multiplied by the efficiency, gives the pressure to be expected. Either member, multiplied by weight of water lifted, gives the power used by the pump; and either member is independent of power used, or quantity of water, though when one of the latter is introduced in the equation, the other is, naturally, determined.

The losses which have already been considered in a preceding article, under the heads of those due to friction, shock, whirls, and escape around wheel crack, can not be separated nor determined, except collectively, by actual trial. Analysis, already made, has shown how to avoid most of these losses so far as is possible. Further avoidance can be accomplished by a careful, and mathematically correct design of guide blades, wheel blades, and port areas.

We have already shown that the radial velocity of the water was dependent upon the quantity alone, the tangential velocity upon the angular velocity, and, therefore, the tangential velocities of entrance and discharge are proportional to the runner velocity and blade shape, from which we have the following three rules, governing the centrifugal pump:

1st. The direction of the water, relative to the runner, in the exit diagram, can be changed only by the shape of the blades.

2d. The tangential component of the exit diagram can be changed in length only by variations in speed or diameter of runner.

3d. The radial component of the exit and entrance diagrams is unchangeable and determines the amount of the relative velocity, whatever the direction of the latter may be. The radial component can be varied by changes in port area only.

A theoretically high efficiency, for a given set of conditions, is very different from a fairly good efficiency over a wide range of conditions, which is the usual requirement of an ordinary commercial pump. Furthermore, a pump is better without guide vanes than with vanes suited to conditions other than for which the pump is designed. To these facts much discussion as to the merits of guide apparatus is due. No doubt, runners and guide blades can be made that will cover a wide range of conditions fairly well.

Having before discussed the entrance diagram and entrance guide apparatus, we now proceed to the development of the suction tip of the blade.

Taking Fig. 1, the circle A, on which the entrance diagram has been constructed, and divide it into twice as many spaces as there are to be blades. On one of the points, C, midway between two blades, construct the entrance diagram according to the data decided upon. From Ue, at C, project a line into the circle A, at right angles to Ue. Tangent to this line, from center of A, draw a circle B. This will be the circle of evolution, from which the blades are to be constructed with non-contracting entrance channels and non-shock entrance.

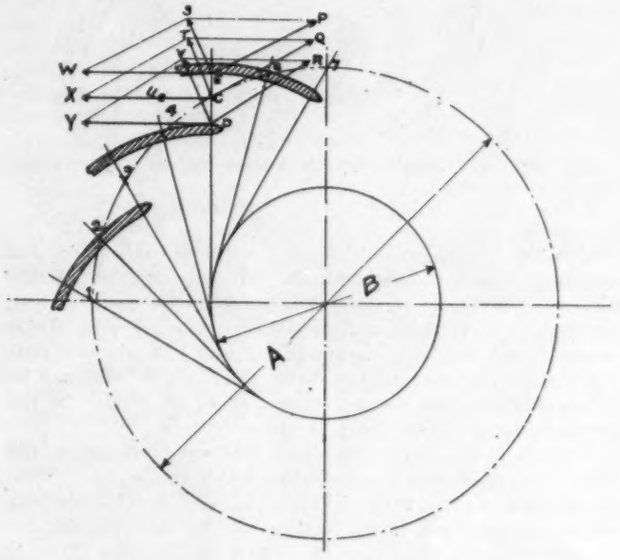


FIG. 1.

From the points 1, 2, 3, 4, C, 6, 7, draw tangents to circle B. Construct the curve of each blade tip as an involute, formed by these tangents winding about the circle B, making them long enough that the entrance E-D is perpendicular to the relative streaming of the water; i. e., the tip of each blade should reach the tangent perpendicular to the line of flow and extend at least as far back as the next tangent, and some fractions of an inch more, before joining the belly of the blade, the construction of which will shortly be treated.

If we lay off entrance diagrams at E and D, we find that the three tangential velocities, P-Q-R, are, of course, different in size and direction for obvious reasons. As X, Y and W are parallel and equal by assumption and necessity, S, T and V must have different values and directions. Therefore, at plane E-C-D will occur shock losses and current friction losses, which, though slight, can be reduced by making circle B as large as possible, remembering that this will cause other losses due to too straight a blade belly, to be considered later; also making suction guide apparatus absolutely necessary, because of the extreme angle of S, T and V, and necessitate a wider runner for the same flow of water.

Added to the diagram shock losses are the shocks due to reduction of port area, due to thickness of blades, fully analyzed in a previous chapter.

Fig. 2. The exit tips of blades are treated in a similar manner. A circle, from which the diameter of the runner has been calculated, is drawn, and the exit diagram BMEH

constructed. At right angles to BM the tangent M2 is drawn and the circle J constructed. Each tangent cuts at right

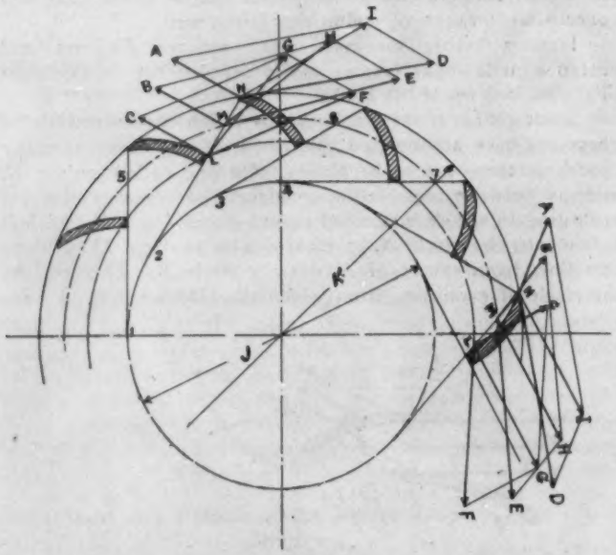


FIG. 2.

angles, the beginning and end of the tip of each blade, and lies in the plane representing the exit area of cross section for the stream. In meeting this condition we have, at last, arrived at the method of determining the number of blades necessary for a pump. Geometric proofs and trigonometric expressions of this graphical work can easily be deduced by simple analysis, but are not necessary to the design of the pump, if the graphical work is carefully done.

As D, E and F are obviously different in direction and value, and A, B and C all similar in direction and value; G, H and I are very different in direction and value and represent shock losses in the absolute exit currents.

When G, H and I are equal and parallel, the plane N M, L is to be taken on a tangent to the other side of circle J. One has then a picture of parallel discharge and the new

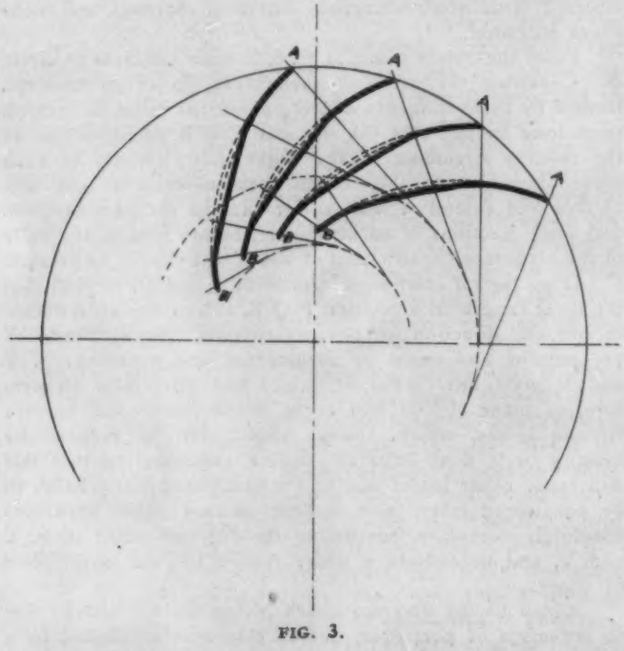


FIG. 3.

positions of A, B and C represent the changing directions of the water, as it passes over the blade curves. From these two diagrams we deduce that, as the blades are the same in both cases, the losses due to shock are only apparent, as all water particles have the absolute direction NI, when exiting from circle K.

Having now established the evolution of both tips and the number of blades, we will take up the development of water channel way, and belly of blade. See Fig. 3.

Having established the shape of the tips, A-A-A and B-B-B, it only remains to place them and connect by arcs (shown dotted). It will be noticed that if the blade follows the curve of the arc, a minimum cross section is offered to

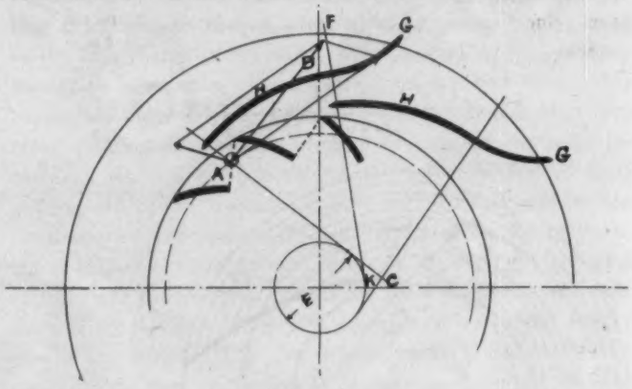


FIG. 4.

the stream, flowing perpendicular to the tangents; hence the blade should be flattened, as shown in an exaggerated degree, thus giving a maximum sectional area of port, that coincides with the sectional area of the stream in direction. The flat part should be evolved as two involutes, developed and averaged from tangents A and B, and with the developing tangent always perpendicular to the blade, because it is, by original assumption, perpendicular to stream lines.

The guide apparatus is laid off as follows: After choosing the number of guide vanes, usually about twenty-five per cent less than the number of wheel blades, lay off the exit diagram on the circle representing the aforesaid theoretical diameter of the runner A.

The water issues from the runner with an absolute velocity and direction B. At right angles to B, from point O, project OC in both directions. Draw circle E tangent to C.

With tangent C and circle E construct blade H as an involute to line FK, from which line the next blade begins, and the space between the blades widens out, gradually changing the velocity of the water to pressure.

The beginning of the guide vane must be at an appreciable distance from the runner for reasons set forth in a previous chapter. We now have a guide vane which receives the water, without shock, in the direction B, and guides it gradually to a radial direction and delivers it at a lower velocity and higher pressure to the casing chamber, the tangents from the controlling circle E being, as usual, perpendicular to port and stream lines.

It would be well to lay out the diagrams for various speeds of runner, showing shock effect of guide vanes. While it has never been done, it would be worth while to make a pump with movable guide vanes, so that they could be suited to various speeds, similar to the control of a water turbine; or the port area of the runner could be varied by having a telescopic wheel, similar to the control used in some of the older types of turbines.

Pumps without guide apparatus, including many commercial pumps, are made more economical by bringing the resultant velocities to as near as possible in direction to the tangential direction, and using a spiral casing. This is accomplished by slanting the blade somewhat forward of the usual positions, and increasing the port area of runner by leaving sides parallel, or nearly so, and the relative velocity is thus partly converted into pressure in the runner itself.

The casing for single pumps should have a spiral form

for a tangential discharge. It is necessary to furnish sufficient stream area at all points. Multi-stage pumps need circular casings, except on the last stage, and here also if with discharge from center, but a circular casing should never be combined with a tangential discharge for the simple reason that half of the water has to reverse its path immediately upon exit from the pump runner, or guide vanes, causing a large shock loss.

This has not been intended as an exhaustive analysis of the centrifugal pump, but merely the merest outline of the principles of design. Later will be given the different systems and types of multi-staging and high duty pumps.

LONG-DISTANCE DIRECT-CURRENT TRANSMISSION.

According to a writer in "Cassier's Magazine," there are 18 plants in successful operation in Europe employing the continuous-current varying-voltage system devised by M. Rene Thury. These plants aggregate 18,000 horsepower, the current varying from 40 to 250 amperes and the voltages from 1,600 to 60,000, the latter tension being used in the Moutiers-Lyons transmission which is over a distance of 112 miles.

The special advantages claimed for the continuous current over the alternating system are as follows:

First—The economy in transmission-line material and switchboards. Recent data show that on a line 95 miles long, the saving in transmission copper, poles, insulators, lightning arresters, etc., was estimated to exceed 50 per cent, where the direct-current voltage was 150,000 (grounded neutral) and the alternating-current, three-phase voltage 60,000, the line efficiency being 95 per cent approximately for the continuous current and 91 per cent for the alternating current, calculated values on the same comparative basis.

Second—The switching arrangements consist of one revolving switch placed on a post mounting the apparatus, and one of these is required for each group of generators, and in addition for the whole station only one other main station switch. This is claimed to lead to extreme simplicity in operation and some economy and saving in the number of operators.

Third—Freedom from lightning troubles is claimed, and it is pointed out that this is obtained by the use of a large inductance at each end of the line, the usual horn arresters and resistance with spark gaps for atmospheric discharge, while inside of all this a large condenser is placed, having the effect of absorbing any high peak of voltage which may pass the other somewhat standard devices.

Fourth—Freedom from mutual induction troubles is also obtained, static or capacity discharge considerably reduced, the distance apart of the wires becoming solely a question of brush discharge.

With the continuous current it is possible to reduce the potential to earth 50 per cent by grounding the middle point of the generating system, the units of which are connected in series; this makes it possible to operate at voltages up to 200,000.

It is now proposed to transmit 80,000 horsepower from the Rhone river to Paris—a distance of 250 miles—using a voltage of 120,000.

LOCATION NOTICE.

The Armstrong-Kreling Machinery Company, dealers in high-grade power plant equipment, have established offices at 88 Second Street, San Francisco, Cal.

APPLICATIONS OF THE FAN BLOWER.

The advent of electrical means of driving very much simplified the application of the fan blower. An electrically driven fan may now be placed at the most convenient point without extended systems of piping and with minimum loss through friction in pipes. Marine installations have called for special designs, in many of which a fan is arranged to be suspended from the deck above and driven by direct-connected motor attached to the side plate. For local or temporary application nothing can exceed the convenience of the motor-driven fan blower, which may be used for the ventilation of tunnels, excavations and the like. It is distinctly portable, renders ventilation positive at the most critical points, and avoids long piping connections. On shipboard portable electric blowers fitted with flexible pipe connections are employed for temporary ventilation of close spaces in the hold.

In modern installations the production and distribution of illuminating gas calls for gas blowers and exhausters, which blow the generators and transport the gas through long distances or from holder to holder. With this arrangement the works may be located at the most convenient point outside the city limits and the gas forced through relatively small pipes under considerable pressure to all parts of the city. Local boosting of pressure may be very simply provided by small blowers. This method of increasing the pressure is almost invaluable in localities where the consumption has outgrown the capacity of the pipes.

In every industry producing relatively light particles of refuse material, such as shavings, sawdust, lint, dust from polishing and grinding wheels, tumbling barrels and the like, the equipment is not complete without an exhaust fan and dust collector, by means of which the air is utilized as a medium for conveying the fine particles away from the source of production and quietly depositing them at a distant and convenient point. The modern buffing and polishing room, the foundry snagging room, the sand blast apartment, are all rendered healthy with a clear atmosphere by the introduction of the fan. Not only does such an arrangement prove effective in the matter of health and cleanliness, but it is important as a factor in reducing the cost of manual labor which would otherwise be required for the removal of the material. This is particularly true in the case of systems primarily installed for the conveyance of materials. Such, for instance, is an installation of fan, piping and suitable switches for transporting cotton, wool, rags and the like. The fan wheel is of special construction to prevent clogging and the system is so arranged that, for instance, wet wool may be passed from washers to dryers, and from dryers to cards, or cotton may be taken from the pickers, transported to the dye house, thence to the dry room and back to the pickers or to the card room. The fan serves to open up, clean and dry the material as it passes, and an expensive system of trucking is eliminated. No modern cotton gin is complete without a fan which draws the cotton direct from the wagon, and continues the process through the gin to the storage bins. Pulp chips in the sulphite mill, tan-bark, brewery grain, coffee, coke breeze and like materials are economically handled by the same process.

The susceptibility of any material to movement under these conditions depends upon the relation of its weight to its superficial area. The open newspaper is among the first to go flying in the air; it better resists the wind when rolled in a wad, and still better withstands such action when compressed into a hard ball. A rocky ledge remains immovable in the wildest hurricane, but the gentlest zephyr will waft it away if ground to impalpable powder.

The pneumatic separator and collector successfully applies the principles thus taught by nature. In such a system a current of air set in motion by an exhaust fan is the vehicle for conveying the fine particles; intensifying the current by restricting the area of passage enables it to pick up the large pieces

Electrical Construction for the Architect

ELECTRICAL FIRES.

An analysis of the report of the Electrical Bureau of the National Board of Fire Underwriters covering electrical fires from January 10 to April 10 of this year shows that there were 141 fires due to defective installation or to careless handling of electric apparatus. It seems that a brief account of the causes thereof would put the architect on his guard in making his specifications for similar installations.

Twenty-one fires were caused by high-tension lines falling on telephone and lighting circuits. Grounding of lighting and motor circuits was responsible for eighteen; short circuits on interior wiring caused thirty-two; electric flatirons four, and moving picture machines nine fires; fuses blowing caused six fires; electric motors, six fires; rheostats and controlling devices, seven fires, and lightning, nine fires. Incandescent and arc lamps have been responsible for five fires. There was one car heater fire and two fires resulting from use of electric bed warmers. All the fires summarized above were reported by inspectors. The losses so reported aggregate $2,748,285.44, but it should not be assumed that these figures represent the entire fire loss due to electrical causes. Many of these were due to careless handling of properly installed aparatus, but the following avoidable accounts illustrate mistakes in installation.

In once case a short circuit at untaped joints caused small damage. The lighting wires were not properly supported and the joints were neither soldered nor taped. No main switch was installed and cut-out was fused with copper wire. At a place where a branch tap was taken off the base wires were drawn together, forming a short circuit. In another case, ordinary Edison plug cut-outs were mounted on the under side of a board which was nailed to the joists supporting the first floor. These cut-outs were subject to moisture, dust and dirt which came through from the floor above, causing the current to arc across the backs of the cut-outs, igniting the board. The flames quickly spread to the floor above, communicating the fire to flimsy dress goods, which were stored there. In falling the burning embers set fire to a lot of empty packing boxes and waste paper in the basement. Loss $1200.

The motors operating fans in the dry room of a tannery were equipped with oil filled automatic starters. The handle of one of these starters was left in the starting position instead of being thrown over to the running position. The starters were so wired that the fuses only protected the motor and starter when the lever was in the running position, where it was supposed to be kept during operation. This scheme of wiring is resorted to in order to prevent blowing of the fuses every time the motor is started as at such times the lines carry heavy overload. The lever could be left in the wrong position through ignorance, carelessness or possibly purposely in order to reduce the speed of the motor. This would result in breaking down the coils of the starter or cause such heating that the oil would take fire. It is probable that the latter was the cause of the fire and the burning oil carried the fire to the surrounding woodwork. Loss was about $30,000.

A large eight-story office building was wired with weatherproof wire in wood moulding. This moulding was in part laid under flooring in cement. Distributing boards for each floor were located in a small closet near elevator shaft and exposed to water leaking down from janitor's sinks on the floors above. Wires were not bushed where they penetrated the closet walls. No main service switch was provided and fuse protection on each floor consisted of very old type open-link fuse-holders. None of these were blown after the fire. Distributing cut-outs were double pole main line plug type with jumpers of copper or very heavy fuse wire around the fuse plugs in nearly every case. Fire started on the fifth floor in the closet, due to the short circuiting of the weatherproof wires in moulding because of the water from floor above. Loss about $150,000.

Transformer was installed in small frame pent house on the roof of residence. The 1100-volt primary wires were carried through the walls of this pent house in ordinary porcelain tubes and without drip loops. Consequently, when it rained, the water followed the wire and grounded it to the walls. The swinging of the wires by the wind also caused them to be cut at the point where they entered the tubes. Sparking finally occurred and set fire to the frame walls. Loss not stated.

A fire was caused by electric light wires becoming grounded on a steel ceiling between the ceiling and the flooring above. Improperly made joints were found lying upon the upper surface of the metal ceiling. Joints were not soldered and only friction tape was used as a protection. The fire burned its way up through the floor above. Damage was slight.

A leakage occurred between the primary and secondary wires of a transformer on pole. The secondary was not grounded, but there were a number of beef coolers fed from it. These coolers were damp and afforded a poor insulation to ground. The wiring in the building where the fire occurred was in rather poor condition. A snap switch that had been mounted on a metal wainscot had one supporting screw not properly screwed home, but in contact with the live metal parts of the switch. One corner of the room was used for cutting salt pork and an accumulation of brine had so soaked the woodwork as to make it a good enough conductor sufficient to allow passage of sufficient current to carbonize and ignite it. Prompt discovery prevented loss.

A three-pole knife switch, controlling the lighting system of a store was too small to properly carry the total amount of current. In time it became overheated and ignited the insulation on the leads and caused a short circuit on the main feed wires, setting fire to the surrounding woodwork. Damage $1500.

Old-style cut-outs with link fuses were installed on the ceiling of the basement of a large department store just over a wrapping table. The contents were not in cabinet, as is required. For some reason the fuses blew and hot fuse metal, falling on some papers on the table beneath, set fire to same. Fire spread with resulting loss (reported) of $60,000.

A fire occurred in the blower room of a theater. This room was located in the front end of the building under the roof. A fuse in a 25-ampere open-link cut-out operated and ignited the insulation of the rubber covered wire at the block terminal. Cut-out was not enclosed in cabinet. The fire ran up the wire and ignited a bunch of paraffined bell wires which crossed the lighting circuit. From these wires the fire spread to wood partition. Loss $450.

An arc lamp was provided with an unapproved pendant snap switch hung on No. 19 lamp cord. The lamp happened to be out of order and an employee turned the current on and left it. The carrying capacity of the cord was entirely too small for the current and the cord heated and set fire to its insulation, which dropped into dry goods beneath. A total loss of about $60,000 resulted.

A cross between primary and secondary wires on overhead lines broke down the insulating joints in frame dwelling. The joints were of an unapproved type. Examination of the lines after the fire showed that the ground wire of the secondary was cut at the pole and therefore useless. Loss $2100.

APPROVED ELECTRICAL DEVICES.

This department from time to time will contain an illustrated description of all fittings approved by the Underwriters' National Electric Association.

SWITCH BOX.

"Marshall." A one-piece pressed-steel switch box for knob and tube work. Cat. No. 1467. Approved Jan. 14, 1907. Manufactured by

Marshall Electric Co., Boston, Mass.

"H. R." A drawn-steel box for knob and tube work. Approved Apr. 9, 1907. Manufactured by

The Holabird-Reynolds Electric Co., Los Angeles, Cal.

TRANSFORMERS.

Rollinson Bell Ringer for 110-120-V., A. C. circuits, supplying secondary voltages of 6, 6-12-18 and 6-16-24, respectively. Approved Feb. 4, 1907. When wiring to primary is installed in accordance with Class C, National Electric Code. Manufactured by

Mohawk Electric Co., Schenectady, N. Y.

WIRES, RUBBER-COVERED.

"Collyer." Approved Jan. 3, 1907. Manufactured by

The Collyer Insulated Wire Co., Pawtucket, R. I.

Approved Jan. 22, 1907. Manufactured by

Waterbury Co., New York, N. Y.

BLACKBURN GROUND CLAMP.

A metal strip secured to pipe by set screw. Approved March 19, 1907. Manufactured by

Geo. R. Blackberry, Cleveland, Ohio.

ROSETTES, FUSELESS.

Mebane, cleat type, Cat. No. "O. K." 74-71, 3 A., 250 V. Approved March 13, 1907. Manufactured by

J. A. Mebane Co., South Boston, Va.

SOCKETS, STANDARD.

G. E. Porcelain Shell, Edison type. Cat. Nos. 9393, 9395, 50799, 39947, 50896 and 34948. For use only in places where they will not be exposed to hard usage. Approved Feb. 13, 1907. Manufactured by

General Electric Co., Schenectady, N. Y.

CONDUIT, OUTLET BUSHINGS.

Sprague, panel and outlet box bushings, styles 6140 and 6120, for securing flexible conduit or armored cable at boxes. Conduit couplings, Cat. Nos. 5115 and 5320, for flexible conduit. Approved April 16, 1907. Manufactured by

The Sprague Electric Company, New York, N. Y.

RECEPTACLES, MINIATURE.

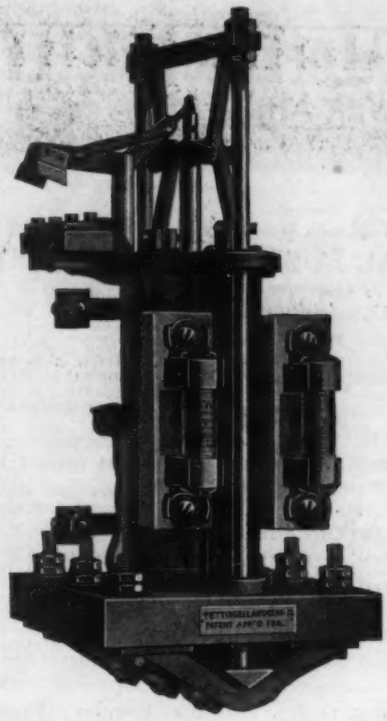
P. & S. candelabra sign receptacle, Nos. 878, ½ A., 125-V. Approved April 12, 1907. Manufactured by

Pass & Seymour, Solway, N. Y.

SIGN, ELECTRIC.

Mobile changeable; galvanized iron grids supported on porcelain blocks in galvanized iron frame; sliding Edison lamp socket. Approved April 16, 1907. Manufactured by

Federal Electric Co., Chicago, for Federal Sign System (Electric), New York.



SWITCHES, AUTOMATIC.

Pettingell-Andrews, for remote control, up to and including 200 A., D. C. 250 V., A. C. 440 V. One, two or three pole. Toggle mechanism, operating laminated copper switch blades by means of control circuits energizing magnets, with or without special iron box, control circuit to be wired throughout as for low potential systems. Approved April 16, 1907. Manufactured by

Pettingell-Andrews Co., Boston, Mass.

SWITCHES, KNIFE.

Davis type B, all capacities, 250 V. Approved April 16, 1907. Manufactured by

The Wesco Supply Co., St. Louis, Mo.

SOCKETS, STANDARD.

G. E. brass shell, key and keyless sockets, with or without shade holders, Edison type, key, Cat. Nos. 9386, 1317, 50760, 1318 and 99386; keyless, Cat. Nos. 9392, 1319, 50768, 1320 and 99382. T. H. types, key, Cat. Nos. 50713 and 50761, keyless, Cat. Nos. 50714 and 50769. Approved April 16, 1907. Manufactured by

General Electric Company, Schenectady, N. Y.

SOCKETS, WEATHERPROOF.

G. E. keyless, bracket, for 650 V. circuits, aluminum or brass shell. Cat. Nos. 32440-32443, inclusive. Approved April 16, 1907. Manufactured by

The General Electric Co., Schenectady, N. Y.

ATTACHMENT PLUGS, FUSED.

Perkins, 2A, 250 V., Edison and T. H. types. Cat. Nos. 3386 and 3387, with glass tube enclosed fuses. Approved April 24, 1907. Manufactured by

Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

CABINETS.

C. H. Co. panelboard, wood cabinet, slate lined, with slate lined gutter. Approved April 26, 1907. Manufactured by

Crouse-Hinds Company, Syracuse, N. Y.

Spranley & Reed, a sheet steel cabinet for panelboards, holes in gutter provided with Federal clamp bushings, also pressed steel switch boxes or service entrance cabinets. Approved April 24, 1907. Manufactured by

Spranley & Reed, New Orleans, La.

The JOURNAL of ELECTRICITY POWER AND GAS
WITH WHICH IS INCORPORATED The Engineers', Architects' and Builders' News

Published Weekly by
THE TECHNICAL PUBLISHING COMPANY
SUCCESSORS TO
The Journal of Electricity Publishing Company
304 Atlas Building, San Francisco.

Yearly subscription, $2.50. Single copies, 10 cts. Back numbers prior to the current month, 25 cts. Foreign subscription, $4.00. Subscriptions cannot be begun with back numbers. Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to The Technical Publishing Company.

EASTERN AGENCIES
NEW YORK
CHICAGO
ST. LOUIS

WESTERN AGENCIES
LOS ANGELES
PORTLAND
SEATTLE

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers', Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XVIII MAY 25, 1907 No. 21

EDITORIAL.

THE ISOLATED PLANT AND THE CENTRAL STATION

The growth and development of the central electric light and power stations in all our great cities has been not only rapid but the extent of territory supplied from each plant has been increased, as well as the size of the individual stations. In the majority of cases, as a result of combining a number of independent companies, power and light are delivered to a single city from one or more plants. The general tendency has been to increase the field of the central stations, its electrical output being used for every class of service.

Isolated or individual electric plants were rapidly introduced soon after the direct-current system was an assured success, and the incandescent lamp and small motor were found to be practicable. Nor were all of these isolated plants small in size. Many large office buildings, hotels and manufacturing plants installed plants of large units, and in most cases the economy of these plants was satisfactory, taking into consideration the unfavorable conditions under which they were operated.

The low-load factor and comparatively small total output as compared with the maximum load, coupled with the high attendance charges per unit of output, resulted in many cases in the shutting down of these isolated plants, all the electrical power required being purchased from the central stations.

Central-station managers have consistently made every effort to shut down isolated plants, and in the majority of cases the cost of power and light has been greatly reduced by the owners of small individual plants making the change. However, it cannot be said that the service has been improved as a result of the change in every case, but the actual reduction in the total cost, including fuel attendance, and fixed charges in most cases, cannot be questioned.

The possibilities of the isolated plant to-day are greater than ever. Especially is this true where gas of the proper kind can be purchased by the isolated plant owner for fuel instead of coal or fuel oil. In many cases the adaptability of gas as a source of power in isolated plants and its small cost when purchased in large quantities, will result in reduced attendance charges, and smaller first cost of machinery. And when the conditions of service are not fully met from the central station, gas-power individual plants for electric lighting and general service will be a most acceptable substitute.

For office buildings and hotels 110-volt direct current is often required for small motors and other domestic uses, and the now common, 220-volt, three-wire, alternating-current lighting systems fall short of the electric service requirements. In such cases the isolated plant has many advantages, and can hold its own with the central station, providing the cost of gas for fuel is not too high, and the attendance charges for the electric plant can be kept down by combining the power and lighting plant with the heating and ventilating system.

A misleading conclusion, however, often results when isolated plant owners fail to realize that depreciation and fixed charges must be included in the cost of operation, in the same manner as fuel costs and attendance charges. Unless every proper charge is made against the complete isolated plant, ultimately it will be found that they are often a very expensive luxury.

CARMEN'S STRIKE IN SAN FRANCISCO

At this writing the strike of the Carmen's Union has been in progress less than three weeks. Tuesday, May 21st, the United Railroads operated 150 cars and carried 90,000 passengers. While the service is by no means restored to normal conditions, Mr. Calhoun has apparently demonstrated that the back of the strike is broken, and that a large number of citizens refuse to injure their own business by becoming a party to a controversy in which they are not directly concerned. Indirectly, of course, every citizen of San Francisco has the gravest concern in the interruption or obstruction of street car service.

The strike has vitally affected all lines of business, the retailers at first being the greatest sufferers; it has demoralized many industries and threatens to paralyze others.

It is obvious that Mr. Calhoun has not the small-

est intention of yielding to the Union's demands; and, indeed, during the last two weeks the rights or wrongs of the strikers have become an entirely secondary consideration. The vital question that now confronts San Francisco is the establishment of law and order, and the re-establishment of confidence. In the twenty days of the strike numerous cases of disgraceful lawlessness and disorder have been reported. The police, until animated by the firm declaration of Governor Gillett to keep order with State troops if the police continued to fail in their duty, proved themselves neither competent nor inclined to fulfill their sworn functions. The police force is the fruit of the present administration, and naturally the sympathy of individual patrolmen is with the strikers.

Both sides to the controversy, as is usual, express confidence as to its outcome. Mr. Mahon, president of the National Carmen's Union, in calm and measured terms expresses his convictions of ultimate victory, while Mr. Cornelius, president of the Local Union, whose style is somewhat hysterical, hurls each morning, through the columns of the press, all sorts of defiance at Patrick Calhoun, and, worse, all kinds of insults at those who choose to patronize the cars.

The management of the United Railroads claim they have closed their doors to the Carmen's Union forever. Mr. Calhoun, evidently, is a man of fearless strength and active ability. There will not be an hour's more interruption of street car service than Mr. Calhoun and his assistants can possibly help. It is said that an average of forty carmen are applying for their old positions every day, and it is further claimed that there is much dissatisfaction in the ranks of the Carmen's Union, owing to unsatisfying payment of pickets and the smallness of the relief granted the strikers.

In the meanwhile, the government of the city remains in chaotic condition. The nominal administration is still that by an indicted Mayor and of self-confessed criminal Supervisors. Such a situation is considered by many to be not only shameful but an unconstitutional farce. The real reins of the administration remain in the hands of District Attorney Langdon, and his assistant, Mr. F. J. Heney, who hold the whip of the penitentiary over the Mayor and Supervisors and can drive them to order.

As is always the case, there are two sides to every controversy. Fully seventy-five per cent., and we do not consider this an extravagant statement, of the Union men are as closely allied to capital in their principles and judgment of right and wrong as any two interests that are dependent upon one another could be in our commercial world.

President Calhoun is in a most trying position before the people of San Francisco, as are also the carmen. One with charges of bribery and threats of indictment as is chronicled each day in the daily press, but yet manfully standing up as he has to carry out his duty to the City of San Francisco as he sees it, deserves at least our admiration. While, on the other hand, fully seventy-five per cent. of the carmen are fighting for a principle, regardless of how trivial the cause might have been.

We consider it the duty of every good citizen of San Francisco to suspend judgment in each of the cases, and await the outcome with patience.

TRADE CATALOGUES.

The Barriett Electric Mfg. Co. of Cincinnati, Ohio, send Bulletin No. 5, showing the construction of their type E motors and generators which are designed as first-class, direct-current machines for withstanding hard work and rough usage.

The Arnold Company, 181 La Salle Street, Chicago, Ill., send a bulletin describing the Elgin and Belvedere Electric Railway, of which construction they had charge.

Bulletin No. 4394B from the General Electric Company, Schenectady, N. Y., illustrates and describes Form P belt driven alternators, which comprise a new line which the General Electric Company is placing on the market to meet the demand for small alternators having good regulation, delivering their output at low temperatures and able to carry a load of mixed character.

Bulletin No. 4497 displays the mechanism of Security Snap Sockets, whose cap and shell are held together by three bayonet catches, doing away with screws.

Bulletin No. 4494 portrays Edison "Gem" high efficiency incandescent units with bowl Holophanes, which throw the light down and spread it out.

Constant current transformer panels for series arc and series incandescent lighting systems are detailed in Bulletin No. 4500.

Bulletin No. 1059 from Allis-Chalmers Company, Milwaukee, Wis., illustrates and describes Allis-Chalmers engine type generators for direct current, type "I." They are designed for general lighting and power service wherever machines suitable for direct connection to steam, gas or oil engines are desired.

PERSONAL

G. Stuart Whyte of the Macumber-Whyte Company of Chicago, has returned home after a short visit to the Coast.

J. B. Livingstone, heretofore auditor of the Oregon Water, Power and Railway Company, at Portland, Ore., has resigned to become associated with the Jersey Central Traction Company at Keyport, N. J.

Lewis E. Ashbaugh, Assoc. M. AM. Soc. C. E., announces his resignation as associate professor of civil engineering, Iowa State College, Ames, Iowa, and his engagement on development of water power as engineering assistant to Robert McF. Doble, consulting and supervising engineer, 22-23 Giddings building, Colorado Springs, Colo.

Mr. G. E. Decker, who has been constructive engineer for the Edison Electric Company at Kern River Plant No. 1, has accepted a position as electrical engineer for the Mt. Hood Railway and Power Company, which is being built to supply light and power to Portland and vicinity. He will leave for Portland on June 1st.

INDUSTRIAL

TEST OF A 500-KILOWATT STEAM TURBINE AND ALTERNATOR.

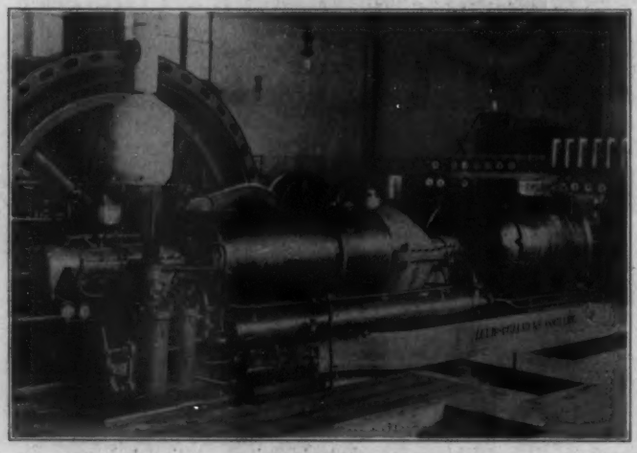
Some interesting tests of a steam turbine have been made by H. L. Rice, General Manager, and Mr. W. M. Willett, Electrical Engineer, of the Western United Gas & Electric Company, in that company's plant in Aurora, Ill. A description of these tests and the results obtained are given below.

Description of Unit.

The steam turbine is an Allis-Chalmers-Parsons standard horizontal turbine, rated at 500 kilowatts.

The generator is a standard Allis-Chalmers turbo-alternator, direct coupled to the above steam turbine, and rated at 500 kilowatts.

The condensing apparatus is of the standard turbo-jet type.



500 K. W., 3600 R. P. M. 60 CYCLE STEAM TURBINE AND ALTERNATOR AT WESTERN UNITED GAS AND ELECTRIC CO.'S AURORA, ILL.

The characteristics of the unit are as follows:

Rated capacity	500 Kilowatts
Speed	3,600 revolutions per minute
Frequency	60 cycles
Winding	2 phase
E. M. F.	2,200 volt
Current per phase (normal)	114 amperes
Construction of alternator	2 pole

The turbine was built to operate normally with steam pressure at 140 pounds per square inch gauge pressure at turbine throttle; dry saturated; and a vacuum of 28 inches of mercury, referred to 30-inch barometer at exhaust nozzle.

The unit is calculated to carry an overload of fifty per cent. when operating under the above steam conditions, and at one hundred per cent. power factor.

Conditions of Test.

The time during which the turbine could be spared for test was limited from midnight Saturday to midnight Sunday; it was, therefore, decided to run only two tests, viz., one at ten to fifteen per cent. overload, and one at three-quarter load.

As the turbine was provided with a jet condenser, the steam consumption had to be determined by weighing the feed water, and to correct this, it was necessary to make a boiler leakage test during the time available for test purposes.

To determine the amount of feed water used, two barrels, "A" and "B," were placed on a platform and connected with one another by a short horizontal pipe introduced into the sides of the barrels near their tops. A water supply pipe with valves was brought over these barrels for the purpose of filling them alternately. Each barrel was provided with a large plug cock in its bottom. The barrels were carefully calibrated, and when filled, so that the water would just enter the connecting pipe above mentioned, they were found to contain—"A," 413 lbs. and "B," 391¼ lbs. of water at 58 degrees F. As the feed water during the test was of a higher temperature, a correction has been made for the difference.

Under the platform, two receiving barrels were placed; into these the upper barrels emptied through the plug cocks mentioned. The lower barrels were connected with one another by a large horizontal pipe near their bottoms, and the suction pipe of the feed pump was brought into one of the barrels.

Two Stirling boilers, of 250 boiler horsepower each, supplied steam to the turbine during the test. Each of the six drums of the two boilers was provided with a gauge glass, and readings of the water levels in all six drums were taken at the commencement and end of the test, and also during the test. The blow-off pipes were blanked off, as were also the feed connections to the other two boilers in the station.

The auxiliary steam header for the feed pumps, etc., was disconnected from the main header, and the portion of the main header receiving steam from the other two boilers in the station was separated from the portion receiving steam from the two boilers which furnished steam to the turbine during the test, by means of a gate valve which was closed tightly during the test. In order that there might be no leakage of steam through this valve, the pressure on all boilers was maintained at about the same point throughout the test, so that both sides of the valve were under approximately the same pressure. From the header supplying the turbine a pipe ran to a 200-kilowatt Hamilton Corliss engine, which was shut down during the test, and the angle valve on the header shut off the pipe. Provision was made, near the engine throttle, to catch the drains from this pipe, but they were found insignificant and were disregarded.

The condensed steam from the steam header, as also from the steam separator near the turbine throttle, was discharged into barrels filled with a gauged quantity of cold water. As the water accumulated, it was taken out in buckets and weighed, and when the water in the barrel became sufficiently hot to vaporize, a weighed quantity of cold water was added. At the end of each test the water in the barrel was brought back to the original quantity.

The feed pump for supplying the calibrated feed water to the boilers was a Duplex outside packed plunger pump. The leakage from this pump was caught and returned to the lower feed water supply barrels. It was not necessary, therefore, to keep records of this leakage.

The steam gauges were checked by an inspector's test gauge which had been verified shortly before.

The quality of the steam during the test was determined by a throttling calorimeter, introduced into the steam pipe just below the separator at the turbine.

A water rheostat was used for providing load for the turbo-unit. Electrical readings were taken from the regular switchboard instruments in the station, and also from a set of calibrated instruments.

Between the overload and three-quarter load tests the boilers were tested for leakage. To determine this, all valves were closed after the boilers had been filled to marks on

the gauge glass, and the boilers kept under a steam pressure of 150 pounds per square inch for four hours. A calibrated quantity of water was then put into the boilers to bring the water level back to the original marks.

The following are the results of the tests:

Aurora, Ill.

First Test.

1. Average load ..... 570.8 kilowatts
2. Per cent of rated load ..... 114 per cent
3. Duration of test ..... 4 hours
4. Steam pressure at turbine throttle ..... 143.3 gauge
5. Steam pressure at turbine inlet ..... 123.02 gauge
6. Vacuum turbine exhaust ..... 26.77 inches
7. Barometer ..... 29.5 inches
8. Vacuum at turbine referred to 30-inch barometer ..... 27.22 inches
9. Revolutions per minute 3600
10. Temperature of feed water 78.8
11. Total water used corrected for temperature ..... 48,544 lbs.
12. Drips from steam header 318.75
13. Drips from steam separator 68.25
14. Boiler leakage ..... 1927 lbs.
15. Moisture in steam by calorimeter ..... 5.12 per cent
16. Actual weight of water chargeable to turbine 43,878.23
17. Actual consumption of dry steam per kilowatt per hour 19.21

WESTERN UNITED GAS & ELECTRIC CO.
(Signed) H. L. RICE, General Manager.
(Signed) W. M. WILLETT, Electrical Engineer.

Second Test.

Aurora, Ill.

1. Average load ..... 385.8 kilowatt
2. Per cent of rated load ..... 77.5 per cent
3. Duration of test ..... 4 hours
4. Steam pressure at turbine throttle ..... 142.4 gauge
5. Steam pressure at turbine inlet ..... 87.0 gauge
6. Vacuum turbine exhaust ..... 27.57 inches
7. Barometer ..... 29.45 inches
8. Vacuum at turbine referred to 30-inch barometer ..... 28.08 inches
9. Revolutions per minute 3600
10. Total water used corrected for temperature ..... 34,552 lbs.
11. Drips from steam heater ..... 397 lbs.
12. Drips from separator ..... 91.5 lbs.
13. Temperature of feed water ..... 83.16 degrees F.
14. Boiler leakage ..... 1927 lbs.
15. Moisture in steam by calorimeter ..... 4.48 per cent
16. Actual weight of water chargeable to turbine ..... 30,612.01 lbs
17. Actual consumption dry steam per kilowatt per hour 19.83

WESTERN UNITED GAS & ELECTRIC CO.
(Signed) H. L. RICE, General Manager.
(Signed) W. M. WILLETT, Electrical Engineer.

The Abner Doble Company, engineers of San Francisco, have appointed Mitsui & Co. to act as their sole agents in Japan and its territories, Korea, China and Manchuria, for the sale of Doble tangential water wheels and hydraulic apparatus. The industrial development that is now taking place in the Orient and the increasing demand for high grade water wheel machinery will make this co-operative arrangement an advantageous one for both parties.

REMOVAL NOTICE.

The Electric Appliance Company of San Francisco have moved from their temporary offices at 315 Main street and are now permanently established in their new and commodious offices and salesrooms at 726-730 Mission street. They have a full line of high grade electrical supplies, which are displayed to good advantage. These include Paranite wires and cables and "O. K." weatherproof line and house wires.

A WISCONSIN MUNICIPAL PLANT.

The City of Marshfield, Wisconsin, has finished the building for housing its new electric light and water works plant, and has started putting in the equipment. Concrete foundations have been prepared for supporting two Allis-Chalmers Reliance Belted Engines, which will be used to drive two Allis-Chalmers alternating-current generators, one of 225-kilowatt capacity, and the other of 100-kilowatt. The engines are 14x30-inch and 18x42-inch respectively, and the generators are 60-cycle, 3-phase machines. Of these two units the smaller will be used to carry the station's day load, leaving the larger portion of the lighting load for the larger machine. Three new 150-horsepower boilers of the horizontal tubular type, 72-inch by 18-foot, will generate steam for the operation of the station. In a sub-station, some distance away, the new pump will be installed seventeen feet below ground, by means of which water will be pumped into the stand pipe. The output from this new unit will be used to supplement the older pumping system, which is still to be kept in commission. The new pump will, however, supply enough water for all ordinary demands.

INDUSTRIAL.

The exposition at Jamestown will show, among other things, what the South has done and is doing in the line of industrial progress. The advance made by the "New South" during the last decade, in the development of her resources of water powers, forests, mineral wealth and agricultural products, has been at a rate which is almost beyond belief.

To the uninitiated the natural resources of the southern States in cotton, coal and iron may seem to be the strong features of Southern opportunity. It is true that they are the foundations on which have been built industries which are among the greatest wealth-creating factors in the world; but they represent only a portion of the South's advantages. It will be found, for example, that one-half of the standing timber of the United States below Mason and Dixon's line, and that the lumbering interests of the South are reaching a prominence which is the result of a steady growth during the past fifteen years. In 1880 the lumber products of the South were valued at $39,000,000. In 1900 this valuation was increased to $90,700,000, and in 1905 the value of lumber products of the South reached the sum of $250,000,000.

While the visible supply of timber in many sections of the North and West is steadily diminishing, southern saw mills are cutting great quantities of pine, and large tracts of cypress and swamp timber are being opened up. The timber supply has been sufficiently gauged to determine its limitations and the effort today is directed toward sawing all timber economically and so conserving the supply.

As typical of the class of improved saw mill machinery found necessary to accomplish this end, the Allis-Chalmers Company of Milwaukee has placed on exhibition, with other of its products, a band mill and saw mill carriage. The band mill was the latest of the principal modern developments in saw mill machinery, and the telescopic band mill is an important improvement in band sawing. The double cutting band mill adds more than 40 per cent to the capacity of the saw mills of America.

To furnish some idea of the execution of which these machines are capable it may be stated that a band mill, operating at one of the leading mills, recently made a new cutting record for the South. Out of 152 logs, consisting of assorted hardwood, ash, oak, gum, maple and elm, cut in nine and three-quarter hours, 98,521 feet of lumber were produced.

BOOKS RECEIVED.

"Self-Propelled Vehicles" is the title of the fifth edition of an "automobile educator" by James E. Homans, that tells not only how, but also why. While complete and technically accurate, it is also sufficiently simple to be understood by any one likely to run an automobile. The 592 pages contain 500 illustrations and diagrams, giving the essential details of construction and many important points of the successful operation of the various types of motor carriages driven by steam, gasoline and electricity. Apparently the presentation of subjects has been determined by consideration of the needs of the man behind the wheel. Theoretical matters—important almost wholly to designers and builders—are introduced only where good explanations positively require them, and at no point is the reader's mind burdened with padded material on experimental and obsolete construction. Considerable space is devoted to complete discussion of the theory, operation and management of the gasoline engine. All the accessory parts of an automobile, carburetters, igniters, transmission gears, are fully explained by typical examples. The author properly assumes that an adequate knowledge of the principles upon which these devices are constructed will enable the reader to understand variations for himself. Examples are given of all the more common machines, yet it is not a catalogue or recommendation for any one make. The book is sold at $2.00 by Theo. Audel & Co., 63 Fifth avenue, New York.

Proceedings of the American Institute of Electrical Engineers, Vol. XXVI, No. 4, contains a complete account of the dedication of the Engineers' Building, together with the addresses and responses given. This, together with the minutes and notices of meetings and a paper by J. S. Codman on "Rates of Charge for Electricity and Their Effect on Cost," complete Section 1. Section 2, papers, discussions and reports, include "Protection Against Lightning and the Multigap Lightning Arrester," by David B. Rushmore and D. Dubois; "New Principles in the Design of Lightning Arresters," by E. E. F. Creighton; "The Rowland Telegraphic System," by Louis M. Potts; "Notes on Hydroelectric Plant Organization and Operation," by Farley Osgood; "Relative Advantages of One Phase and Three-Phase Transformers," by John S. Peck; "Forced Oil and Forced Water Circulation for Cooling Oil-Insulated Transformers," by C. C. Chesney; "Enclosed Station Wiring," by F. O. Blackwell; "Potential Stresses as Affected by Overhead Grounded Conductors," by R. P. Jackson; "The Telephone Wire Plant," by Sergius P. Grace; "Light from Gaseous Conductors Within Glass Tubes—the Moore Light," by D. M. Moore.

PUBLICATIONS RECEIVED.

Volume 28, No. 10, of the Proceedings of the American Society of Mechanical Engineers contains the following papers to be read at the Indianapolis meeting, May 28-31, 1907: "Superheat and Furnace Relations," by R. P. Bolton; "Air Cooling of Automobile Engines," by John Wilkinson; "Materials for Automobiles," by Elwood Haynes; "Superheated Steam on Locomotives," H. H. Vaughan; "The Economy of the Long Kiln," C. E. Soper; "Railway Motor Car," B. D. Gray; "Analysis of Locomotive Test," Prof. S. A. Reeve; "The Ordnance Department as an Engineering Organization," General William Crozier; "Entropy Lines of Superheated Steam," Prof. A. M. Greene; "The Heating of Stone Houses," H. O. Lacount; "Special Auto Steel," T. J. Fay; "Materials for the Control of Superheated Steam," M. W. Kellogg; "Ball Bearings," Henry Hess.

EXAMINATION FOR ENGINEER.

The United States Civil Service Commission announces an examination on June 19, 1907, to secure eligibles from which to make certification to fill the following named vacancies as the result of examination in Branch 1, steam engineering, and vacancies as they may occur in the Indian service in the engineering positions indicated below. Engineer, qualified in acetylene and gasoline gas, $800 per annum, Carson, Nev. For this position it is desired to secure an engineer who has had experience in the use of acetylene and gasoline gas, which experience must be shown in the application. Engineer, qualified in gasoline gas lighting system, $720 per annum, Arapaho, Okla. For this position it is desired to secure an engineer who has had experience in the management of a gasoline gas lighting system, which experience must be shown in the application blank.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the Board of Examiners.

The United States Civil Service Commission announces an examination on June 19-20, 1907, to secure eligibles from which to make certification to fill the following-named vacancies in the position of clerk-draftsman in the offices of the Surveyors General of the Land Office service, at the places indicated, and similar vacancies as they may occur: One, $1400 per annum, San Francisco, Cal. Two, $4 per diem each, Phoenix, Ariz. One, $4 per diem, Helena, Mont. Two, $4 per diem each, Reno, Nev.

FULL ELECTRIC SERVICE ON THE NEW YORK CENTRAL.

Complete electric service over the zone extending between the Grand Central station and Highbridge on the main line was instituted on April 23, when, for the first time, the Twentieth Century, the Empire State Express, and other noted trains were hauled through the Park avenue tunnel by electric locomotives. For several months the local and suburban trains of the company have been under electric operation, part of them under the multiple-unit system, and the rest hauled by the new 95-ton locomotives. The change from electric to steam locomotives is made at Highbridge in four or five minutes; but the company expects ultimately to reduce this time to two minutes. The party of officials which went out to Highbridge was treated, incidentally, to a display of the great hauling power of the new equipment, when one of these locomotives picked up a disabled steam locomotive, with its freight train of fifty-six cars, and hauled it to the yard with comparative ease.

FAREWELL DINNER.

Mr. E. G. Dewald, until recently the San Francisco manager of the Platt Iron Works, was tendered a farewell dinner at Tait's Cafe on Thursday evening, May 16, by a number of his friends. Since coming to the Coast eight years ago, Mr. Dewald has done much to advance water-wheel design and construction and his absence will be keenly felt by the profession. The dinner was given as a mark of appreciation and thanks for his services and also served to welcome his successor, Mr. C. R. Newcomb, Jr., who has already earned the regard of the machinery men. The good fellowship at the table emphasized the spirit of co-operation and the determination to advance Coast power plants by those present.

NEWS NOTES

INCORPORATIONS.

Fresno, Cal.—The Coalinga Four Oil Company has filed articles of incorporation with a capital stock of $50,000.

Fresno, Cal.—The Fresno Mutual Electric Light Company has been incorporated with a capital stock of $50,000. The sum of $30,000 has been subscribed by Tong Duck, Sing Chung Lung, and five others.

San Luis Obispo, Cal.—The Premier Oil Company has been incorporated with a capital stock of $500,000, shares $1 each. The directors of the concern are Neil Cook, C. K. Bright, James Taylor, T. A. Norton and E. T. Ferguson.

Los Angeles, Cal.—The Wonder Electric Power and Water Company has been incorporated to develop power on two streams located in what are known as the Silver of Stillwat Mountains, twelve miles north of Wonder townsite.

San Francisco, Cal.—The San Francisco Railway and Power Company has been incorporated here with a capital stock of 1,000,000 shares, $100 each. Those behind the project are B. F. Clarke, F. C. Boeckmann, G. K. Ford, G. E. Bennett and J. R. Sloan.

Bakersfield, Cal.—The American Crude Oil Co. has filed articles of incorporation with $500,000 capital. The directors of the corporation are J. M. Danzinger, W. F. West, D. C. Wallace, M. H. Hannas and E. A. Randolph, all of Los Angeles, the principal place of business.

TRANSMISSION.

San Francisco, Cal.—The Sierra Power Company applied last week for a franchise to erect stations, power lines, etc., and to equip an electric plant in this city for the transmission of power from the Sierras and its distribution and sale for all industrial purposes.

Redding, Cal.—A three-days' battle of three rival electric companies before the Board of Supervisors was settled on May 14 by the adoption by the supervisors of an ordinance providing for the crossing of the lines of the different companies. A senior company, says the ordinance, must be given thirty days' notice by a junior company that the latter wants to cross. Within that time the senior company must raise its wires or the junior may stretch its wires above those of the other. The expense of elevating the wires must not exceed $350 in any instance and the junior company must pay this. The Northern California Power Company, the first company in the field, clings tenaciously to the point of having its wires on top.

Sacramento, Cal.—The property of the Northern Electric Company at 1020 Eighth Street will soon be converted into a baggage room and ticket office for the accommodation of passengers when the company has its interurban line running into Sacramento from Marysville, Chico and Oroville. The company is rushing work on its lines to this city and expects to be operating cars here about August 1. It has already laid the track from Nineteenth and B, where it enters the city, to Fifteenth and G Streets, where it will cross the tracks of the Sacramento Electric, Gas and Railway Company.

Carson, Nev.—The big power proposition being planned for Woodfords, Alpine County, Cal., by the California-Nevada Power Company is rapidly assuming definite shape, according to the statement of President F. G. Baum, who passed through this city on his way to Woodford, where he goes to close the deal for several large holdings of land needed by the company for its project.

ELECTRIC RAILWAYS.

Moscow, Ida.—It is expected that grading on the Spokane and Inland Railway will be completed between this city and Palouse by July 1.

Spokane, Wash.—Council will pass, May 14th, upon a new franchise sought by J. P. Graves of the Spokane Traction Company, covering a large number of new streets in the city.

Spokane, Wash.—The Panhandle Electric Railway and Power Company, capital $1,000,000, has been incorporated by Thomas W. Payne of Michigan; Amasa J. Smith, Harry W. Wallace, Spokane; Andrew Coolin of Idaho, and John R. Jones of Hillyard.

Monroe, Wash.—A franchise was introduced in the Council granting to the Seattle-Tacoma Power Company the right to come into Monroe. The franchise as it stands is a straight 50-year grant, without any restrictions or provisions. Attorney Norwood W. Brockett of Seattle, representing the power company, was present.

John P. Horgan, chief building inspector of San Francisco, has filed with the Board of Works the following table showing the volume of building operations in this city for one year from May 19, 1906, the date upon which the building bureau assumed control after the fire:

	Number.	Value.
Class A	36	$ 7,985,000
Class B	69	5,493,750
Class C	876	24,462,956
Frame	5,364	25,094,223
Alterations	2,483	5,539,138
Total	8,828	$68,575,067

The fees collected amounted to $104,637.50. Horgan says that the statement does not include any buildings erected as permanent or temporary previous to May 19, 1906, of which there were many and which are not of record in this bureau.

San Francisco.—At 10.17 o'clock Tuesday evening the residents on Church Street between Fifteenth and Sixteenth were awakened by a brilliant flash of light. Going to the windows they saw that an iron chain had been thrown over the trolley wire and the high-tension wire, sending up a bright flame. At the same time two men were seen running down Church Street, making good their escape after committing a felony which resulted in the burning out of the switchboards at the Turk and Fillmore substations and throwing the entire system of the United Railroads on the north of Market Street out of commission.

The company officials, headed by Chief Electrician Bivins, collected men to hurry repairs at the substation, and they completed the work in time to turn on the current again at 7 o'clock, when the first cars were run.

The act of vandalism was well planned to do the greatest amount of damage and was evidently perpetrated by some electrician who knew that the high-tension current from the San Francisco Gas and Electric Company's wires was taken on the United Railroads system at this point in Church Street. By throwing an iron chain over the two wires the current of 13,200 volts was short-circuited, and in the same instant the switchboard at the Turk and Fillmore streets substation burned out with a brilliant flash of light.

TELEPHONES.

Albany, Ore.—Home Telephone Company is constructing a trunk line from Corvallis to Peoria.

Butte, Mont.—Independent Telephone Company is erecting a new building on West Granite street, which is to be completed in six weeks.

Bakersfield, Cal.—The supervisors have granted the petition of J. V. Morley for permission to construct a telephone line along the Kern Island road.

Raymond, Wash.—Citizens favor granting a franchise to an independent telephone company, and are dissatisfied with the service rendered by the Pacific States Company.

Bellingham, Wash.—The Puget Sound Telephone Company asks franchises for lines over certain county roads, which will be heard by the County Commissioners June 5th.

Anacortes, Wash.—The city telephone office has moved to a new location in the Wells Building, and has an entire new outfit, switchboards, batteries, etc. Miss M. L. Childs, manager.

Ellensburg, Wash.—N. B. Watson, of the Pacific States T. & T. Co., requests a franchise of county commissioners for a line from this city over certain county roads. Board will act June 3d.

Tacoma, Wash.—The reported merger of all the independent telephone lines in the United States is said to be untrue, and given out to injure new independent telephone construction in the west.

Ferndale, Wash.—Council demanded 5 per cent of gross earnings, free water and option of buying plant of Ferndale Light, Water and Telephone Company before granting franchise, and the company will not commence business.

Ballard, Wash.—Council refused to permit Sunset Telephone Company to erect any more poles in the city on account of reported bad service. Ballard will soon become a part of Seattle, when the Independent Telephone Company can operate there.

Lakeport, Cal.—T. H. Gray, of San Francisco, representing the Pacific Telephone and Telegraph Company, has been in town looking over the telephone prospects with a view to running into Lakeport what is known as a toll line. This will probably be done. The company desires to improve the telephone service in Lake County.

Ely, Nev.—F. H. Harriman, manager of the Utah-Nevada Telephone Company, announces that his company will at once begin the construction of a line to run parallel to the Western Pacific from Salt Lake City to Ibapat, thence directly to Ely. The corporation is a branch of the Rocky Mountain Bell Telephone Company.

Fourteen lines will be utilized and the board for their accommodation has been ordered and will be put in place in the near future. The dispatcher's office at Pasco, Wash., and Trout Creek, Mont., will be connected. This will facilitate the work of dispatching trains at these points, where divisions have a terminus. The board will be in charge of three shifts of girls, each working eight hours.

The Northern Pacific Railway Company will install an independent private exchange in its general station in Spokane. The change will be made to concentrate the company's business and take it away from the Pacific States Telephone Company, thus assuring quicker service. The lines will connect the superintendent's office, the general agent's office, the yard offices, the local freight office, the depot ticket office and the apartments of the trainmaster, roadmaster and claim agents, the telegraph room and the round house.

Victoria, B. C.—The government has announced its intention to install wireless stations along the British Columbia seaboard. To enter into communication with these the Canadian Pacific Railway is placing instruments on its coasting vessels, the Princess May and the Princess Royal. The former vessel is now on the Victoria-Skagway run. The new Princess Royal is being rushed to completion at the yards of the Marine Railway Company and will be fitted with the wireless apparatus before being placed in commission next month. Wireless stations will be installed at Bamfield and Cape Luzon, Vancouver Island, and at Princess Rupert and other points on the mainland.

John T. Huetter will build the Home Telephone Company building in Spokane, where the contract for $60,000 was awarded a few days ago. This calls for the construction of the building proper, which must be completed by November 1. Excavation for the building was completed several weeks ago. The company has also put up a number of poles in the city and laid underground wires to be in readiness to put its plant in operation as soon as the exchange is completed. Cyrus Happy, vice-president of the Home Telephone Company of Spokane, declares there is no truth in the report that the corporation will be bought out or absorbed by the Pacific States Telephone Company. He added: "The ordinance covering the granting of a franchise to the company by the City Council provides that it cannot be sold to any corporation, company or individual. The franchise even prevents us from combining with any other company regarding rental and toll prices."

Chicago, Ill.—The development of the plan to cement seven thousand telephone companies into one gigantic organization is expected to follow the gathering in this city next month of one thousand managers and presidents of the interested companies. The men will come as delegates to the convention of the International Telephone Association to continue three days from July 4 at the Auditorium Hotel. The independent telephone associations of thirty states, with approximately $350,000,000 invested, are to send delegates to this convention to urge forward the movement to unite. Long-distance telephone lines throughout the country, giving unified service to more than 3,000,000 users of independent telephones, are contemplated. Ohio is leading the agitation with 300,000 independent telephones in use. Indiana is second with 200,000. The call for consolidation has come at the close of the most prosperous year in the history of the independent concerns.

Spokane, Wash.—State Auditor Bragaw announces that a much larger number of telephone and telegraph companies will pay taxes in Idaho this year than ever before. He has 53 companies on his list, a gain of more than 50 per cent over 1906. Under the Idaho law, the County Assessors are not charged with the duty of assessing or collecting taxes on the property of railroads, telegraph or telephone companies. This duty falls to the State Auditor or the State Board of Equalization. But with this delegation of authority, the law bequeaths no method of ferreting out the companies. He may send notices to the company listed in the office of the Secretary of the State, but unless they respond readily, or he goes out in person and hunts them down, he may not know whether they are real or fictitious organizations; whether they have one mile or 1000 miles of line in operation. Mr. Bragaw advised the County Assessors to look up such corporations, with the result given in the foregoing.

FINANCIAL.

San Francisco, Cal.—Captain Payson, president of the Spring Valley Water Company, has submitted to the Executive Committee of the Federated Water Committee a statement and figures concerning the standing of the company. This was in accordance with the request made at a previous meeting of the committee. At the session at which the report was made a committee composed of Charles Heuer, Jas. D. Phelan, and Walter McArthur, was appointed to investigate the statement and consult persons familiar with its technical features.

San Francisco, Cal.—The Union Oil Company will increase its dividends on May 20 from 75 cents to $1 a share a month, which is twelve per cent a year on the par value, $100. The Union Provident Company and the United Petroleum, both holding companies for the Union, have increased their payments from 75 cents to $1 and from $1.38 to $1.48 a month respectively. In his annual report President Stewart predicted that the dividends for 1907 would be more than double those of any previous year. With the second quarter they have increased thirty-three and one-third per cent.

Oakland, Cal.—Water rates for the fiscal year beginning July 1 were fixed last week by the City Council on the basis of the agreement reached by Councilman Pendleton, chairman of the Finance Committee, and Louis Titus, manager of the People's Water Company. This provides for a cut of ten per cent in present rates to general consumers, twenty per cent on city water, and forty per cent on fire hydrants. The agreement carries with it the understanding that there will be a further cut made the following year. Councilman Pendleton submitted a report showing in detail the figures upon which he had reached the cut and also the elements covering the San Pablo Creek supply.

Colfax, Cal.—Arthur L. Pease and James D. Stewart have started a suit in the Superior Court of this county against the South Yuba Water Company and the California Gas and Electric Corporation to get an injunction and $25,000 damages. Pease states that he owns a ditch, extending from Bear River to Gold Run, a distance of about fourteen miles, and that the South Yuba Water Company owns a ditch known as the Boardman Ditch in the same vicinity. The South Yuba ditch parallels that of Pease for a half mile and lies higher up on the hill. The former is in a dilapidated condition and recently broke and washed away a large portion of Pease's ditch. Pease claims that by reason of the neglect of the upper ditch it is liable to break away and destroy his at any time.

Redding, Cal.—The Northern Light and Power Company has brought suit in the Superior Court to condemn the rights of about twenty-five land-owners along Cow Creek in this county to about the 5000 inches of water in said creek, which the company desires to use for commercial purposes. The defendants are Henry Stacher, S. D. Wilcox, D. G. Hunt, J. M. Heryford, Frank Joseph, Nancy Toepfel, Chas. A. Hufford, J. R. Hunt, T. L. McBride, Etta Crews, Kahn & Abels, Nancy A. Fisher, H. M. Glover, Estate of J. F. Howard, J. K. Mears, Warren G. Atkins, Mrs. F. Arnold, C. F. Glover, John Bonds, Chas. Rippenberger, N. C. Brown, Chas. L. St. Vrain, L. A. Meeker, and J. W. McBride. The power company bases its claim on a water right of 5000 inches, filed on Old Cow Creek in 1904. The point of diversion is above the ranches of the twenty-five defendants. The company proposes to take thsi water from Old Cow Creek and lead it through ditches and flumes to its powerhouse site, where it will be turned into another stream, The company proposes to take this water from Old Cow Creek at a point below the ranches of the defendants. The water will be lost to them forever so far as irrigation purposes are concerned, and with the 5000 inches taken from the original stream there will not be enough left in the dry season, when the water is needed most, to begin to supply their needs. The company bases its right to take the water on the ground that it is a public service corporation. In other words, it has the same right to condemn riparian water rights that a railroad has to condemn a farmer's land for a right of way for its tracks. The power company asks the court to determine the amount of damage each defendant farmer will suffer. It proposes to pay what it takes. The suit is without parallel in the history of Shasta County. The farmers had supposed their riparian rights inalienable.

INCORPORATIONS.

Spokane, Wash.—The Standard Oil Company of Spokane has been incorporated for $25,000, with W. H. Broadus of Spokane, Dr. A. C. McKendry, and Dr. J. L. Hennifin of Butte as incorporators. Within three months the company intends to enlarge the plant and put in new machinery. The new improvement will cost at least $10,000.

Portales, New Mexico.—A company has been organized to put in a waterworks system. The capital stock is $15,000, a majority of which has been subscribed by local citizens. Hugh Lewis is president of the company, Seth Morrison secretary and treasurer, and Coe Howard manager. The president and manager will leave shortly for St. Louis to purchase the machinery for the plant and the pipe lines.

ILLUMINATION.

Lodi, Cal.—H. C. Keys, promoter of Lodi's proposed new gas plant, states that work on the new plant will commence within one month, or even sooner if it can be arranged.

Santa Barbara, Cal.—To meet growing demands the gas company will make extensive improvements this summer costing $12,000. The capacity of the plant will be increased. Harry Burkhart will have charge of the construction.

Goldfield, Nev.—William G. Beckley of Colton, Cal., wants to establish a crude oil gas plant in Goldfield and writes to the Chamber of Commerce all about it. He seeks capital here to help him out.

San Rafael, Cal.—Under direction of Manager Foster of the San Rafael Gas Company, an effort is being made to ascertain the wishes of the Mill Valley people in the matter of extending the gas-pipe line from San Rafael to that place.

OIL.

Oakland, Cal.—The Southern Pacific Company is erecting another big oil tank in the West Oakland yards, near the new roundhouse.

Bakersfield, Cal.—It is currently reported that the Fulton Oil Company has closed a contract with the new Sunset refinery, now being built in the Sunset fields, by which the refinery acquires all the output of the Fulton Company for the next five years. It is said that the price scale is graduated, running between thirty cents and forty cents, the highest price paid for local oil.

Bakersfield, Cal.—The Maricopa Oil Company of Sunset has recently closed a deal with the Gate City Oil Co., a newly formed corporation with Stockton capital, by which the south half of the holdings of the Maricopa are leased to the new company, which will use and market the oil itself. The land leased consists of twenty acres of the choicest land in the Sunset fields. As yet no development work has been done, but the new company will put a string of tools to work at once and it is expected that a good strike will follow soon.

FINANCIAL.

Antioch, Cal.—The Antioch Oil Company has declared an assessment of 1½ cents per share, delinquent June 1; sale day, June 15.

San Francisco, Cal.—The Berry Oil and Development Company has declared an assessment of $1 per share, delinquent May 29; sale day, June 15.

San Francisco, Cal.—The annual meeting of the stockholders of the Buena Vista Petroleum Company is to take place May 20 at 412 Front Street, in this city.

San Francisco, Cal.—An assessment of ten cents per share has been declared by the Record Oil Company. The assessment is delinquent June 15; sale day, July 8.

Porterville, Cal.—Assessment No. 7 of $10 per share has been declared by the Copa de Oro Water Company of this place. The assessment is delinquent June 1; sale day, July 1.

Lemoore, Cal.—An assessment of ten cents per share has been declared by the Lemoore Oil and Mining Company. The assessment will be delinquent May 28; sale day is June 18.

San Francisco, Cal.—A special meeting of the stockholders in the California and New York Oil Company's Consolidated is called for 10 a. m., June 1, at 1300 Golden Gate Avenue. The meeting is to be held for the consideration of the sale of the properties of the company and the proposition of consolidating properties of other companies.

San Francisco, Cal.—Judge Sewell has dissolved the restraining order secured by some stockholders of the Keystone Oil Company to prevent the sale of their stock to pay an assessment of $2.50 a share. It was stated in court that the oil company was in debt over $100,000, $87,000 of which is due A. B. Spreckels. The restraining order had been issued on the assertion that no due notice of the levying of the assessment had been given.

San Francisco, Cal.—The Geary Street Railway Company paid into the city treasury last week the sum of $1240.35 as five per cent of the gross receipts of the road during the month of April. The earnings of the road have nearly doubled as compared with the period previous to last year's disaster. In the last ten months the company has paid into the city treasury the sum of $12,243.90. The gross receipts of the road amounted to $244,878. The percentages received monthly were as follows: June 21 to July 31, 1906, $1172.11; August, $1493.84; September, $1397.45; October, $1207.54; November, $1149.65; December, $1230.47; January, 1907, $1115.41; February, $1045.55; March, $1182.53; April, $1240.35.

Santa Clara, Cal.—An indebtedness of $60,000 has been incurred by this town for municipal improvements. The amount is distributed as follows: $30,000 for the construction of a sewer system, in forty bonds of $750 each and bearing interest at the rate of 4½ per cent per annum; for the reconstruction and repair of the light and power works, $21,000, in forty bonds of $525 each bearing 4½ per cent interest; for repairing the two schoolhouses of the town, $9000, in forty bonds of $225 each and bearing 4½ per cent interest. An ordinance calling for bids on the improvements proposed has been passed by the Board of Trustees. May 23 is the last day on which the bids may be handed in.

WATER WORKS.

Coalinga, Cal.—Holmes Henshaw and associates have undertaken the piping of water from the artesian well, generally known as the McClurg well, to within a mile of the town. At present the well is flowing five hundred barrels per day. Two pumps will be installed, as well as storage tanks on hills adjacent to the well. A reservoir is planned for the future.

POWER AND LIGHT.

Kennewick, Wash.—Poles are now being erected for the installation of arc lights on Front and Second streets.

Seattle, Wash.—The Capitol Hill Improvement Association is circulating a petition for cluster street lamps, fed by underground wires.

Tacoma, Wash.—Merchants on C street have had ornamental cluster electric lamp posts set between Ninth and Thirteenth streets at their own expense.

Kalispell, Mont.—Plans are being prepared by the Flathead Valley Water Power Company for improvements to the Big Fork Electric Power and Light Company, to cost $50,000. L. W. Tingle, manager.

Evanston, Wyo.—The Evanston Electric Light Company is contemplating installing a 150-kilowatt direct current unit, Corliss engine and two 125-volt machines for operating an Edison three-wire system. George J. Mercer, manager.

Snohomish, Wash.—P. E. Hall proposes to lay gas mains from Everett to this place and supply this city with gas. He has purchased the necessary pipe and construction will commence as soon as the franchise is granted for the line by the County Commissioners.

Bellingham, Wash.—Articles of incorporation of the Northern Light Company were filed in the County Auditor's office. The capital stock is placed at $1,500,000. The incorporators are J. H. Ambrose, Fred E. Lees, W. H. Chase and E. M. Hawkins. The principal place of business will be in this city.

Oroville, Wash.—Two carloads of machinery have arrived for the Oroville electric light plant and its installation is under way. Among the equipment received are large transformers which will prevent a great waste of current in transmission from the plant to the point of its use. The plant is located at Similkameen Falls.

Roseburg, Ore.—A city election was held here to vote on amendments to the city charter to authorize the City Council whenever they may deem it necessary, or the people by initiative, to call a city election to vote bonds to install water and light systems at a cost not to exceed $250,000, also amending the charter so as to provide a better and more effective manner of street improvement. The proposed amendments were carried by a vote of about 10 to 1.

Nelson, B. C.—The absorption of the Cascade Power Company, with a capacity of 6000 horsepower, by the West Kootenay Power Company makes the latter the second largest power company in Canada. It has a total horsepower exceeding 30,000 and the plant's capacity may be doubled with available water power. The only competing plant is that of the city of Nelson, 1500 horsepower, which can be increased to 6000 easily, and which is designed to supply Nelson with light and power.

Seattle, Wash.—The Seattle Lighting Company has asked permission to lay gas mains on Dexter avenue, from Mercer street to Roy street; King street, from Thirteenth avenue South to Thirty-first avenue South; East Forty-fifth street, from Second avenue Northeast to Fifteenth avenue Northeast; Fourteenth avenue Northeast from East Fifty-sixth street to East Fifty-eighth street; and East Fortieth street, from Tenth avenue Northeast to Fifteenth avenue Northeast; also Thirteenth avenue South, from Judkins street, to Atlantic street, and Twenty-second avenue, from East Cherry street to East Terrace street.

ILLUMINATION.

Escondido, Cal.—At the last regular meeting of the City Council an application was presented by Wheaton & Foster for an electric light and power franchise.

Douglas, Ariz.—The franchise asked of the city by the Douglas Improvement Company for water, electric light, and telephone privileges has been defeated by popular vote, 281 to 69.

Yuma, Ariz.—Seth Hartley is here to start work on the gas plant and system for which he was given a franchise by this city in January. Z. T. Bell is the contractor and work will start in a short time.

San Francisco, Cal.—Captain B. F. Cheatham, constructing quartermaster, has advertised for bids for furnishing material and labor and installing a complete electric lighting system and furnishing electric current for Forts Baker and Berry. The work is to be done in accordance with plans and specifications on file at the quartermaster's office, 1086 North Point Street, San Francisco.

Oakland, Cal.—Councilman Ellsworth of this city has expressed considerable doubt of the utility of the electroliers that were installed recently along the principal business streets of Oakland. He has told the members of the Merchants' Exchange that because of the mechanical difficulties the light given off was not so great as it ought to be. He said that this fault may be overcome and an effort will be made to bring about a remedy.

Santa Cruz, Cal.—The Coast Counties Electric Light Company has sent its officials here on a tour of inspection to the works here. They have decided to add a new gas machine to the local equipment at the plant here, of which Van E. Britton is manager. Arrangements have been made to double the capacity of the high-pressure gas-distributing system. Arrangements were also made for the building of a six-inch suction pipe from the pleasure pier out into the bay to supply water for the power house and other beach buildings, to take the place of the eight-inch pipe formerly used.

Sacramento, Cal.—Professor C. L. Corey, head of the College of Mechanics at the University of California, was in this city last week as the guest of the committee appointed by the Board of Trustees to investigate the cost and maintenance of a municipal electric lighting plant. He went over the ground in the neighborhood of the city sump and garbage crematory and also visited several other sites which have been considered suitable for a city plant. No selection was made, Professor Corey stating that he would like to have time in which to make calculations and estimates. He would not set any amount as the cost of the proposed plant. When he does make his report to the committee, the latter will inform the Board of its decision. Several city officials, including Mayor Beard, City Engineer Randle, Superintendent of Streets Irvine and Trustees Carragher and Roder, consulted with the university man as to the advisability of raising bonds for the purpose. It has been suggested that the city issue ten-year bonds and have the plant erected by a private concern. The latter would have to take its remuneration in yearly installments which could be derived from the regular tax levy. Mayor Beard and the city officials who have talked over the scheme are enthusiastic and believe that it will be an easy matter to establish a municipal system.

TRANSPORTATION.

Los Angeles, Cal.—Work has commenced on the new electric line to be built by H. F. Huntington from Pasadena to Dolgeville, through Monticello and the Pallet ranch in the Ranchita Valley to Downey and thence to Signal Hill at Long Beach.

Santa Rosa, Cal.—The Sonoma & Lake County Electric Railway has petitioned for a franchise from the city of Cloverdale to be permitted to come into that city with its road. The work of construction is to begin at once and the road has purchased the Peter McKenna property on Railroad Avenue for a depot site. The road is to be standard gauge and will transport passengers, freight, mails, and express matter. It will operate cars of the most approved pattern, provided with safety fenders. The money for conducting the road has all been provided for, and it will run from Cloverdale, on the Northwestern Pacific Railroad, and tap the summer resorts and resources of Lake County.

San Francisco, Cal.—President Platt, of the Geary Street Railroad Company, has notified the Board of Supervisors that he would not run his cars under the union schedule. As a result, the temporary permit under which the road has been operating was taken from the company. President Platt held a meeting with his directors before the announcement, and it was decided that, while it would be possible to resume car service upon agreeing to pay the old employees the $3 and 8-hour wage scale demanded, it would be impossible under any other circumstances. The directors refuse to make this concession to the carmen, even in the face of losing their license to operate the line. There are $671,000 of the bonds of the Geary Street Company outstanding, which are held all over the world. On these bonds it will be impossible to realize more than one-third of the face value, according to A. D. Shepard, the secretary of the company. The bonds are a lien on the equipment, rolling stock, and property of the company, but without a license to run cars this property will be of little value and must be disposed of at a sacrifice. In its dealings with its employees the company has been most liberal. The back pay under the award of the board of arbitration was paid as far back as August 26, and the employees have never had any grievance which was not speedily adjusted until the recent strike.

OIL.

Visalia, Cal.—If the proposed pipe line is laid, it will probably go through the Devil's Den, so that that field will at last have an outlet if it can be made to produce. The only development now going on there is by Smith & Bryant, who have leased the lands of the Visalia companies and are down one thousand feet. The Avelna, a company controlled by the Balfour and Guthrie people of Coalinga, has seven thousand acres and drilled a number of very shallow holes during the early days of the oil boom, none of which went below seven hundred feet, and some showed small quantities of oil. No work has been done for several years and the company is just holding its lands. The Western Oil Company (Spreckels) is holding a large body of land, doing only its assessment work. Two or three rigs are reported going up in the Krevenhagen district. These are owned, it is said, by the Krevenhagen brothers, the land owners and ranchers from whom the field is named. They sold for $10 an acre lands around Coalinga in the early days and the property is now held at $1000 per acre.

ELECTRIC RAILWAYS.

Seattle, Wash.—The Seattle Electric Company has begun the construction of its line down Prefontaine place.

Tacoma, Wash.—The American-Hawaiian steamer California has arrived here with 60 carloads of steel rails for the Orting line of the T. R. and P. Co.

Lewiston, Ida.—J. H. Morrow, general manager of the Walla Walla-Columbia River Electric line, states his company will extend their line to this city.

Tacoma, Wash.—Miller & Bischu have been awarded the contract for the erection of a brick car house 103x113 feet, to be built by the Pacific Traction Company at South Sixty-fourth street and Union avenue. Plans by Frederick H. Heath.

Bellingham, Wash.—Jacob Furth of Seattle states that the interurban electric railway for which surveys are now being made in Whatcom and Skagit counties, with Bellingham as a center, is to be the nucleus of a system connecting Bellingham and Seattle.

Eugene, Ore.—A. Welch of Portland, who is to build the street railway line for the Willamette Valley Company, states that construction of same will commence at once, and material is now arriving. He is also negotiating for purchase of the city water plant.

Grass Valley, Cal.—It is believed here that work will be started soon from a point near Lime Kiln on the grading for the California Midland Electric Railroad. John Martin is expected to arrive shortly with a number of his associates, and it is believed that he will order a big camp to be established at Lime Kiln. Some time ago he purchased 200 tons of hay and ordered it held at that point.

San Francisco, Cal.—The Supervisors' Judiciary Committee has refused to accept the bond of the Presidio and Ferries Railway Company, in the sum of $50,000, to insure the reconstruction of the Union Street Cable road into an electric system. The bond had been approved by Mayor Schmitz, but the committee took the ground that it was not worth the paper upon which it was written, as it was not dated and did not bind the company in any way to complete the road in nine months, the time required by the ordinance. The bond was referred to the town attorney for an opinion as to its efficacy.

Clarkston, Wash.—J. H. Morrow of Waitsburg, Wash., general manager of the Walla Walla and Columbia River Electric line, states that it was the intention of his company to make a survey from Dayton to Clarkston the present summer and that if a satisfactory route could be secured the line would undoubtedly be built to this city. Mr. Morrow also stated that it was the intention of his company to effect a junction with the Spokane and Inland at some point on Snake River; that Clarkston is the natural point for this connection and if an entrance to this city on a satisfactory grade can be secured the connection will be made here in preference to any other.

Tacoma, Wash.—The first building of what will become an extensive system of car barns and shops is to be erected by the Pacific Traction Company at Union avenue and South Sixty-fourth street. The buildings will be of solid brick, one story high. It will be used as headquarters for

FOR GAS COMPRESSORS see RIX C. A. & D. Co., S.F.

CLASSIFIED LIST OF ADVERTISERS

Air Compressors
Henshaw, Bulkley & Co.
Rix Comp Air & Mach. Co.

Alternators
Allis-Chalmers Co.
California Electrical Works
National Brake and Electric Co.

Aluminum Electrical Conductors
Pierson Roeding & Co.

Annunciators
California Electrical Works.
Century-Klein Electric Co.
Holtzer-Cabot Elec. Co.
Patrick, Carter & Wilkins Co.
Tel. and Elec. Equipment Co.

Asbestos Products
Johns-Manville Co., H. W.

Automatic Sprinklers
Pacific Fire Extinguisher Co.

Batteries, Primary
California Electrical Works
Gould Storage Battery Co.
Standard Electrical Works
Western Electric Co.

Batteries, Storage
Century-Klein Electric Co.
Gould Storage Battery Co.
Electric Storage Battery Co.
Tel. and Elec. Equipment Co.

Blue Printing
Dietzgen Co., Eugene

Boilers
Henshaw, Bulkley & Co.
Keystone Boiler Works
Moore, C. C. & Co., Inc.
Risdon Iron Works
Standard Electric Works
Tracy Engineering Co.

Boiler Compounds
Dearborn Drug & Chem. Wks.
Johns-Manville Co., H. W.

Buffers
Northern Electrical Mfg. Co.

Building Material
Johns-Manville Co., H. W.

Building Paper
Johns-Manville Co., H. W.

Circuit Breakers
Fort Wayne Electric Works
Century-Klein Electric Co.

Compressed Air
Pacific Electric Mfg. Co.

Condensers
O. C. Goeriz & Co.
Moore, Chas. C. Co., Inc.
Rix Comp Air & Mach. Co.
C. H. Wheeler Mfg. Co.

Conduits
American Circular Loom Co.
American Conduit & Mfg. Co.
Tel. and Elec. Equipment Co.
Century-Klein Electric Co.

Conduit Fixtures
American Conduit & Mfg. Co.
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Cooling Towers
O. C. Goeriz & Co.
Moore, Chas. C. Co., Inc.
C. H. Wheeler Mfg. Co.

Cross Arms
Century-Klein Electric Co.
Tel. and Elec. Equipment Co.

Drawing Materials
Dietzgen Co., Eugene

Dynamos and Motors
Allis-Chalmers Co.
Brooks-Follis Elec. Corp.
California Electrical Works
Century-Klein Electric Co.
Pacific Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Holtzer-Cabot Elec. Co.
Northern Elec. Mfg. Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co
Wagner Elec. Mfg. Co.

Elevators
Van Emon Engineering Co.

Electric Car Heaters
Johns-Manville Co., H. W.
Northern Electrical Mfg. Co.

Electric Grinders
California Electrical Works
Northern Electrical Mfg. Co.
Tel. and Elec. Equipment Co.

Electric Heating Devices
Johns-Manville Co., H. W.

Electrical Instruments
Cutter Co., The
Century-Klein Electric Co.
Fort Wayne Electric Works
General Electric Co.
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

Electrical Machinery
California Electrical Works
Northern Electrical Mfg. Co.
Standard Electrical Works
Century-Klein Electric Co.

Electric Polishers
Northern Electric Mfg. Co.

Electric Railway Appliances
Pierson, Roeding & Co.
Johns-Manville Co., H. W.

Electrical Supplies
California Electrical Works
Century-Klein Electric Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.

Electric Ventilating Fans
Century-Klein Electric Co.
California Electrical Works
Northern Electrical Mfg. Co.

Engines, Boilers, Heaters, etc.
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore, Chas. C. Co., Inc.

Electric Watchman's Clocks
Pacific Fire Extinguisher Co.
Tel. and Elec. Equipment Co.

Engineers, Chemical
Smith, Emery & Co.
Moore & Co., Chas. C., Inc.
Ohmen Engine Works
Standard Elec. Works
Tracy Engineering Co.
Westinghouse Machine Co.

Engines, Gas and Gasoline
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore & Co., Chas. C., Inc.
Westinghouse Machine Co.

Engineers and Contractors
Brooks-Follis Elec. Corporat'n
Byllesby & Co., H. M.
California Electrical Works
Cannon, Edward F.
Century-Klein Co.
Copeland, Clem A.
Doble Co., Abner
Cory, C. L.
General Electric Co.
Hunt, Dillman, Meredith & Allen
Jackson, D. C. & W. F.
Smith, Emery & Co.